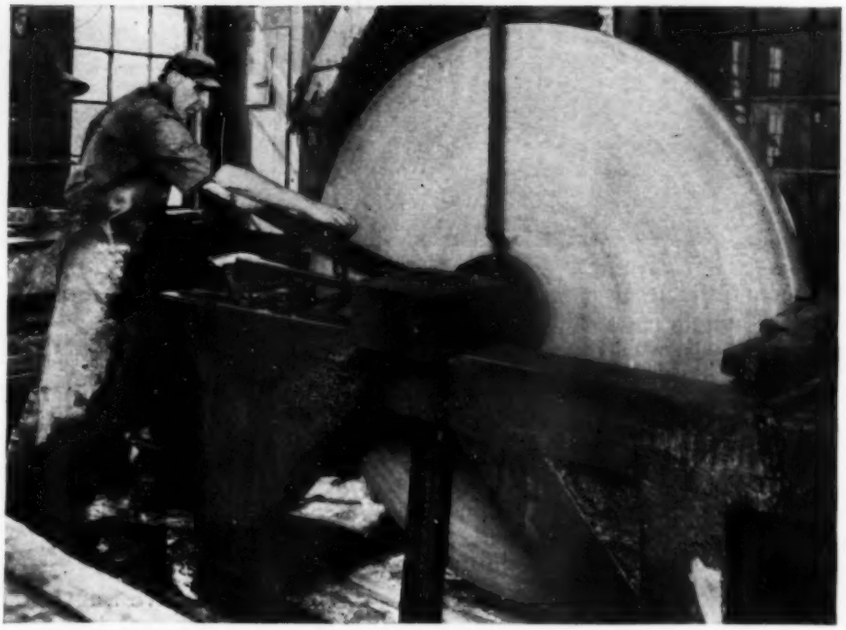
American Machinist

ESTABLISHED 1877
McGRAW-HILL PUBLISHING COMPANY, INC.
New York, March 3, 1932
VOL. 76 No. 9



The old-time grinder was an artist. With a wheel of this type he ground tools, dies and scrapers. In some cases the wheel was placed in a pit and the grinder sat astride of it at floor level

How They Grind Small Tools

We present in this and forthcoming articles a study of small-tool grinding methods as practiced in various types and sizes of metal-working plants

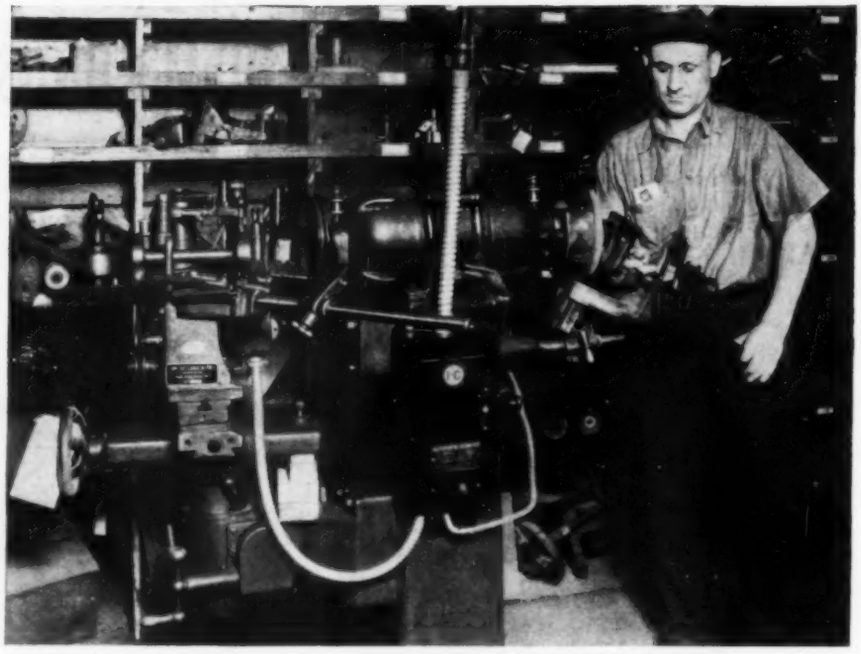
IN CONVERSATION, a shop executive some time ago confessed, or declared, that the one shop rule he had never dared promulgate would order all tools to be ground in the tool room or a special grinding department. This same executive expressed the opinion that there were few, if any, shops in the country that really carried out this policy. When asked why he had never dared, he replied that he did not know of any way efficiently to serve men using a multiplicity of different tools, and scattered over a wide area, without the handling charges offsetting the benefits.

Recently, we received a letter that recalled the above conversation and crystallized our thoughts on the subject into action. The letter reads as follows:

"Since the advent of carbide cutting tools and chromium-plated drills, reamers and taps, our losses on tool spoilage seem to have increased out of all reason. This may be due to the increased cost of the new tool, because the average shopman does not understand grinding this class of tool, or it may be that ordinary floor grinders are not suitable.

"Spurred by the increased cost I investigated the methods used in our shop. As a result of this investigation, I wrote several executives I know and asked them if they had noticed any difference in the cost of jig repairs, or in the life of a drill because of eccentric grinding of the latter.

"These executives were no wiser than myself. They



For large and medium sized drills, machine grinding is obviously necessary. It is just as necessary for small straight shank drills, but the reasons are not quite so apparent

all admitted that a drill with one lip longer than the other must crowd the bushing, and wear both it and the drill. They also agreed that much of the drill breakage might be due to this same eccentricity, especially in deep holes. They could also see how a large drill ground off center would rack a jig severely. None of them, however, had given this phase of the subject much attention, but promised to do so.

"Inspired by what I had discovered, I wrote an order that no tools of any description should be ground in the shop. I knew from experience that this would raise a protest from my staff, so before showing it to them I went to the tool-grinding room to study capacity and to find room for the floor grinders which would have to be removed from the shop.

"We have in our tool-grinding department a large and a small drill grinder, a universal tool grinder and two floor grinders, besides two cutter grinders. At the time of my visit four machines were busy. On the universal tool grinder new tools were being ground, the largest drill grinder was in use, and two men were resharpening lathe and planer tools on the floor grinders. Being more interested at the moment in drill grinding, I watched the man sharpening large drills. To my surprise, I found that he was grinding by hand. I asked why. He explained that the grinder V-guide was broken, and that he could grind drills by hand just as well. I looked at some of the drills he had ground, and they looked all right to me. I then asked him if the men in the shop could grind them equally well. He waxed profane and said, 'You just ought to see some of the drills that come back from the shop. On the average I have to grind away a thirty-second more than I should on every blankety-blank drill to straighten it up.' I asked him about the chromium-plated ones. He replied that they were worse still for some reason. As I was leaving, he said 'If you want to save a lot of money, stop them smart alecks in the shop from grinding drills.'

"I then questioned the leading man about the universal tool grinder, and he said it couldn't be beat for a batch of new tools, but that he didn't like it for grinding only one angle on a single tool. I asked about tungsten carbide. His only reply was that tungsten carbide and shopmen are a costly combination as far as grinding is concerned.

"That is the situation. My reaction is to move all floor grinders into the tool-grinding department, but my superintendent enters so strong a protest about men losing time going after new tools that I hesitate about issuing the order. I am determined to try some remedy. I understand that in one of the railroad shops a man goes around with a stock of tools on a three-wheel barrow, and exchanges a sharp tool for a dull one. I may try that.

"I would like to have the views of some of your readers on the subject. Is there really a shop where 100 per cent of the tools are ground in a separate department? Is there a machine on the market that will grind economically a single angle of a single tool? Would it be economical and good practice to put drill grinders in the shop?"

A Comprehensive Survey

The importance of centralized grinding seemed so important that we thought it preferable, in order to get a comprehensive survey of the matter, to first submit the question to responsible executives of representative companies in different branches of the metal-working industry, and then invite the comments of our readers. It also occurred to us that it was fitting, and might be profitable, to write to some of the firms that manufactured the grinders on which the tools were ground and some of the people who made the tools that were ground. We also sent letters to several industrial engineers in this country and abroad who might be expected to be informed upon general practice. We mailed out twenty such letters and received sixteen replies.

Three general questions were asked in the letter, which went out with a mimeographed copy of the letter we had received from the inquirer: "Of your own knowledge are you acquainted with any firm that grinds 100 per cent of its tools in a separate department? Would it be feasible to place a tool or drill grinder in the shop? Would an expert grinder at each floor grinder be the best practice?"

The list of firms to whom this letter was sent is representative of the best in America. In view of the authority such a list would have and the influence it would exert, it is to be regretted that it cannot be given in its entirety, and all the letters published over the individual or firm name. The majority, however, have given their consent to publication:

Black & Decker Manufacturing Co., Towson, Md.
Small apparatus, varied product, compact shop.

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Medium sizes, similar product, several departments.

One plant of a gigantic corporation. Small apparatus, single product, several departments.

Main plant of a very large corporation. Large range of size and variety, many divisions.

Gifford-Wood Company, Hudson, N. Y.
Varied product, largely non-repetitive, small shop.

Glenn L. Martin Company, Middle River, Md.
Seaplanes exclusively, compact shop, modern.

Norton Company, Worcester, Mass.
Medium to large machines, varied product, fairly compact shop.

Graham-Paige Motor Corp., Detroit, Mich.
Automobiles, repetitive work, large shop.

Plymouth Motor Corporation, Detroit, Mich.
Automobiles, repetitive machine work, large shop.

Taft-Peirce Company, Woonsocket, R. I.
Contract work, large for this type of work, compact.

Union Twist Drill Company, Athol, Mass.
Manufacturers of drills, taps and dies and milling cutters.

Wagner Electric Corporation, St. Louis, Mo.
Medium sized work, wide variety, several departments.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.
Range of product from massive to microscopic, both contract and repetitive. Widely scattered departments.

William Sellers Company, Philadelphia, Pa.
Massive to medium in size, large variety, fairly compact departments.

Worthington Pump & Machinery Corporation, Harrison, N. J.
Medium to large apparatus, large variety, largely non-repetitive, departments scattered.

The professional engineers, were Sydney Cornell of New York and James R. Cornelius of Great Britain.

From such a list, the standing of those other firms whose policies or opinions forbade the disclosure of their identity may be gaged. The mere fact that they answered our inquiry under the circumstances is an indication of both the importance of the matter and of their courtesy.

An attempt to summarize the answers received to the three questions from the different firms does not allow us to arrive at any definite conclusions regarding tool practice. Only one of them claims to grind 100 per cent of tools in a special department. Each firm uses a different system, and each finds the system used to be satisfactory. All of the companies except one grind tungsten-carbide tools in a tool room. The one who does not follow the general rule makes exceptions in particular cases.

There are only two firms that do not have floor grinders distributed around the shop. In most cases these are for tool bits or small drills. The query regarding the feasibility of placing tool or drill grinders in the shop was answered in the affirmative by all those who answered the question at all, while the matter of stationing skilled men at floor grinders located throughout the shop found as many for as against it.

It is, of course, impossible to send out the same questionnaire to a group of people without receiving many practically identical replies. Some letters are, therefore, given in full, while others are abstracted. Though some are given under the firm name, others are anonymous by request.

In one case, the company suggested that a staff member visit the plant and personally review the situation. This was done, and a short article on its centralized grinding practice will be given later to outline the whole proposition of centralized tool grinding for the benefit of those who have not yet attempted to install it.

Psychology enters largely into the solution of any major problem. It may be stated as a general proposition that the essentials for the solution of any problem of shop management are in use somewhere as elements of some system, or even lack of system. But so strong is the persistency of the established that the likelihood of collecting and combining all the elements of perfect practice is so remote as to be practically non-existent. Professional engineers break down this barrier to some extent, but they have, in a lesser degree, the same failing as the rest of us. Another barrier is the so-called "nature of the business" that inhibits the adoption of the practice of one type of business for the use of a different one, or of one shop for use in another.

Next week and in another succeeding issue will appear the letters in which the plants referred to outline their individual practices.

Standardization and Progress

INVENTIVE minds often oppose all forms of standardization as hindering progress. Inventors usually see chances for improvement after, or even before, each machine is completed, and want to embody the improvements in the next machine. While such a practice may be highly laudable from the theoretical point of view, every production manager knows what it does to costs. Nor is it solely a question of profit for the builder, it affects the user as well, and the slight improvement is often more than offset by the extra cost of replacements. The experience of an owner of a fleet of motor trucks gives both sides of the story.

Following the sometimes questionable practice of patronizing only local industries, he bought his trucks of a nearby builder, of the type who was constantly "improving" his product. As a result, every truck he bought was different in some particular from all the rest, and his cost for maintenance was abnormally high. The lack of standardization made it difficult to secure replacements without taking the worn or broken part to the factory for identification, and the time lost from the earning capacity of the trucks was no small item in itself.

The experience resulted in his buying all new trucks from a builder who made but few changes in his designs, and these changes were so planned that replacements could be easily secured. Some of the main items in this truck had practically remained unchanged over a ten year period, but the results, in day after day trucking, made the older design a more profitable investment.

In too many cases, so-called improvements are simply opportunities for the inventor to display his ingenuity without appreciable economy in operation or maintenance. The cost of making the change and the added difficulty in replacement frequently works against the user as well as the maker. Real progress is always to be commended. But lower production costs, which affect the price to the user frequently mean greater real economy than fancied improvements or constantly changing designs. We must strike a balance that will give the best result to all concerned.

Press Tools for Coil Base Stands

C. W. HINMAN
Chief Tool Designer, Kobzy Tool Company

Fig. 1 — A simple device that required more study than is apparent at first glance

LOOKED AT casually, this shell looks like an "inside-out" job. Looked at a second time, it might seem like a flanged shell operation and a bottom trimming job; but as we study it further we find that the shell is too high in relation to its diameter for a flanged shell that cannot be ironed out. Eventually, the job narrows down to a shallow flanged cup with the following sequence of operations.

Fig. 1 shows the finished piece, and the size specifications are given in Fig. 2. The material is deep-drawing steel, 0.025 in. thick, and the stand required three operations to make.

The tools for the first operation were a conventional blanking and drawing set that drew the body of the shell to the correct finished diameter and $\frac{1}{2}$ in. deep instead of to $\frac{51}{64}$ in., the finished depth. The die was set so as to leave a flange approximately $2\frac{3}{4}$ in. in diameter, later trimmed and turned up to form the outer rim.

The second operation tools shown in Fig. 3 pierce the two 0.098-in. holes in the flange and a 0.900-in. hole in the bottom of the cup. They also blank the contours around the holes in the flange and trim the outer edge of the blank at the same time. Two chisel-type scrap cutters cut these trimmings so that they fall away from the die.

The perforating, blanking and trimming operations are performed at the same time, which means that the punches are at different levels, as are also the dies. This involves no difficulty in sharpening, as both the upper punch and outside die are separate, and the stepped punch and die in the shoe are also separate. The upper stripper plate is cupped out to go over the body of the work. This stripper and also the knockout in the center of the 0.900-in. punch are operated by the knockout bar in the ram of the press. Two shouldered screws, not shown, prevent the stripper from falling out.

The third, and final operation opens and straightens out the annular ring left by the 0.900-in. piercing operation in the bottom of the shell, and also draws up the rim of the cup as shown in the finished piece. This

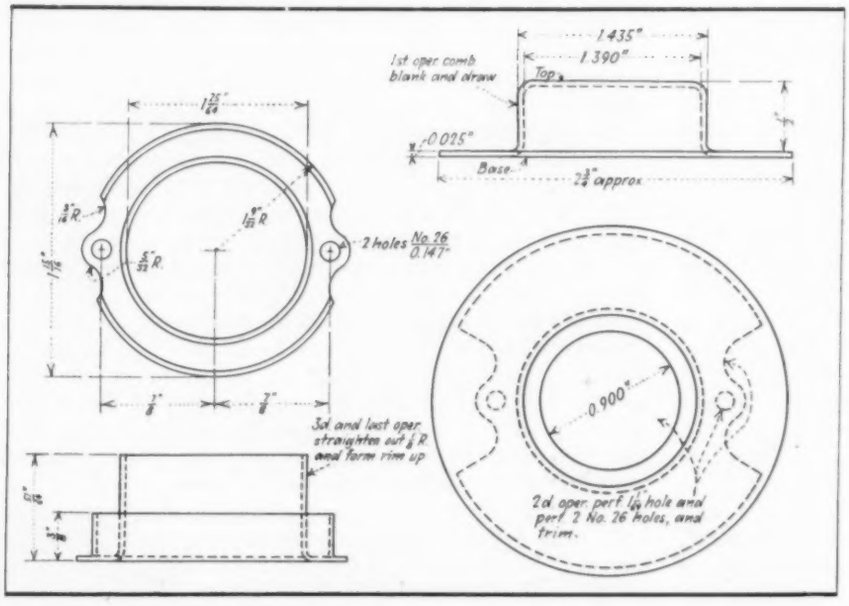

1.435"
1.390"
1st oper. comb blank and draw
Top
.025"
Base
2¾" approx
2 holes No. 26 0.147"
3d and last oper. straighten out ½ R. and form rim up
0.900"
2d oper. perf. 1/16 hole and perf. 2 No. 26 holes, and trim.

Fig. 2 — Specifications of the coil stand

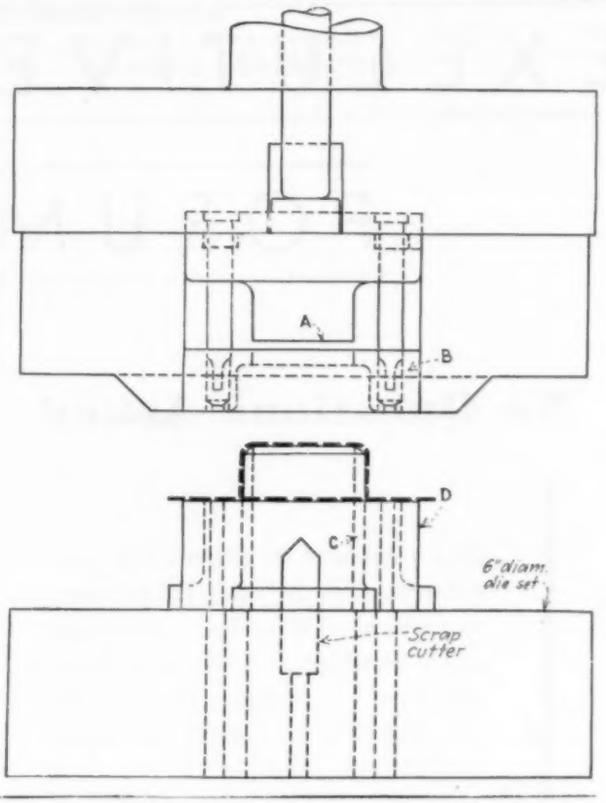


Fig. 3—Two-step die performing punching, shearing and trimming operations at once

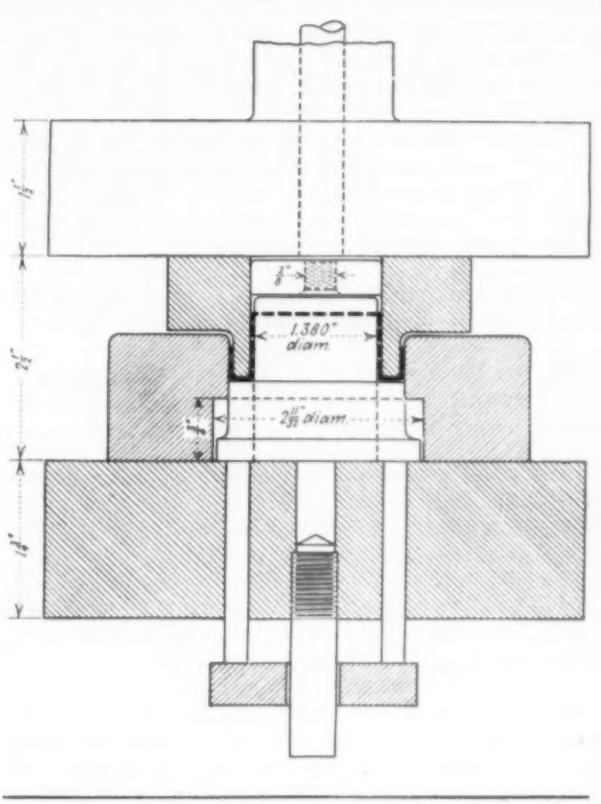


Fig. 4—The bottom is pushed through the shell and the flange is drawn up

ring adds $\frac{1}{64}$ in. to the height, or depth, of the shell. The fit between the punch and die must be close, because the piece must be bottomed and the opportunity to iron out the crease usually caused by the radius that joins bottom and side is limited. The finished part does not show any wave whatever in the metal at this very important place.

It will be noted that the perforated ears stand out beyond the outside diameter of the cup, thus complicating the final drawing die somewhat. The part sticks to the punch and is ejected by the ram knockout bar.

Welding a Soldered Joint At 3,200 Degrees

ALTHOUGH the welding of stanless steel is no longer difficult, an unusual application sometimes arises which offers more of a problem than the usual welding process. Such a problem presented itself recently, and its solution offers a possible aid to many others using this comparatively new alloy.

In making an Allegheny Metal food container, a manufacturer wanted to solder the seam on the inside of the tank, also to weld along the outer flange for greater strength. Solder would cover the seam smoothly and prevent food particles from lodging which might decay and contaminate subsequent batches. He found, however, that after the welding operation had been performed, a hard oxide deposit in the seam prevented the solder from adhering. If the process were reversed, the high temperature required for welding (3,200 deg. F.) would melt the solder (Melting point—450 deg.).

Engineers of Joseph T. Ryerson & Son, Inc., Chicago, suggested a plan that was successfully demonstrated recently. To avoid the objectionable deposit of oxide, the tank was soldered and partly filled with water before welding. The water served to check the intense welding heat that followed, and prevented the solder from melting while the welding was being done.

Water within this Allegheny metal food container permitted the operator to weld the joint outside *after* it had been soldered inside; soldering after welding was not possible due to the oxide film

EXECUTIVE FORUM

No Questions Asked

Firms engaged in engineering and contract work are often called upon to build machinery from some one else's drawings. They commonly call attention to inaccuracies in detail and thus save their customers considerable trouble in the final assembly. But what should be their attitude when the whole project looks technically unsound? Do engineering ethics demand criticism of the design or the refusal to build a machine which the builder believes will not function properly? Or should the assumption be that the customer knows what he wants and is willing to pay for his experiment? What do you think about this problem?

THE TELEPHONE on Fred Longman's desk buzzed insistently. The chief engineer of the King Machinery Company pushed aside the pile of blueprints he had been studying and lifted the receiver.

"Will you please come to my office for a few minutes?" asked John Edwards, the company's president. "Bring your estimates on the Bergen diesel engine. Jim Sargent is down here with me." Sargent was King's enterprising sales manager.

Longman entered the president's office soon after with a sheaf of figure-covered papers in his hand.

"Did you get far enough to make up a quotation?" asked Edwards. "Sargent thinks he can close the order if we act promptly."

"I've covered everything except a few details which won't take long to clean up," said Longman. "This is a big job and will run close to $35,000. But I don't think we should quote on it."

"Why not?" asked Sargent. "$35,000 orders don't grow on trees these days. As I understand the job, it's just the kind of a contract we need."

"That's true enough," said Longman, "but Bergen's design simply won't work. He's got a two-cycle diesel with a cylinder scavenging method for forcing out the exhaust gas. It looks all right in theory, but from previous attempts that have been made in this direction, I am convinced that the engine will not do what he expects of it. I'm no diesel expert, but if it were my design, I wouldn't spend a cent on it."

"When Bergen submitted his drawings," said Edwards, "I gave him to understand that we assumed no responsibility for the successful operation of his engine other than for materials and workmanship. If he places this job with us, he has no comeback concerning its design."

"But should we allow a man to invest a large sum in a design that gives every indication of failure?" asked Longman. "Perhaps Bergen would have no legal claim against us, but our reputation would suffer."

"Look at it this way," Sargent suggested, "Bergen has a reputation as a successful inventor. He is convinced in his own mind of the merit of his design and is ready to back his judgment with a sum which he can well afford. Why should we attempt to discourage his trying it out? Bergen is a stubborn individual. If we start to pick flaws in his drawings, he'll simply take them elsewhere to have his engine built. And if anyone's going to get the job, we might as well have it."

"That sounds reasonable," said Edwards. "If Bergen were staking his last cent on this engine, I would hesitate to take his money. But he's made a great deal on previous patents. If this design goes wrong, it won't be the first. Every inventor has some failures."

"Can't we point out the weaknesses of the design?" Longman asked. "Then if he still insists on our making it, we can do so with clear consciences. I believe that by eliminating some of his radical features, the engine can be made to work."

"But Bergen has no interest in building the conventional type of engine," said Sargent, "if we did succeed in convincing him that his innovations won't work out, he'd have no need of carrying the project further. Besides, how do you know that after his first machine is built, he won't think up some modification that will make it a success? Most new machines have a few bugs in them when they're first built. There's no use in our saying it can't be done."

"Well, the design doesn't look good to me," persisted Longman, "and I believe we should tell Bergen so."

"He wants a quotation," said Sargent, "not advice."

Suggested by Harry Shaw, Heywood, England.

Discussions Of Former Subjects

Rolling Stones

The principal reason for apprenticeship is to supply the need for men whom it is difficut to find, or who can only be obtained at excessive salaries. The object should be to fill vacancies, and there are vacancies even today. In fact it seems even more difficult to find just the right man for certain positions now than it did in boom times.

If apprentices are properly selected and trained, the possibility that the job may not be ready when the man is ready is quite remote, especially as the vacant positions are usually the broader positions. There is seldom a shortage of narrow specialists. I do not believe that any boy who had successfully completed our apprenticeship program would find any great difficulty in securing a position quite comparable with what he was ready for, even today, and even in case we could not supply one for him. The shortage of that kind of man is too great everywhere —A. W. Forbes, *Forbes & Myers.*

Iron and Gold

The foundry of one large automobile manufacturer is considered a separate institution by the cost accounting department and carries only its own overhead. None of the administrative expense of the plant is charged to it, neither the engineering nor the sales expense. The costs of castings produced in this foundry are actual costs. The castings are charged to the machine shop at cost, which includes the foundry's overhead but no profit.

Foundry scrap found in the machine shop or an assembly department in this plant and defective castings returned from the service department are charged against the foundry. This is an element in the cost of producing castings, as is the scrap found in the foundry by the foundry inspection department. No machining or assembly loss caused by defective castings is charged back to the foundry.

The making of patterns for new models is done on an appropriation which is charged to the general expense of bringing out a new model and is not charged to foundry overhead. The making of any additional patterns after the parts are in production is charged to the foundry as are also any changes necessary to make the patterns work correctly.

White is correct in asking for proper methods of accounting if his boss is going to make comparisons of his costs with jobbing foundries. That costs may be accurately compared is the reason for using the method described. The same practice is followed in the forge shop. When parts produced by either the foundry or forge shop are sold to any of the company's subsidiaries, a profit is charged. —P. W. Abbott.

Control By Council

All the legislation in the world, and all the advisory councils and "stuffed shirts" that may be brought together will not compel people to cooperate. Cooperation during prosperity means curtailment of expansion and production activities and preventing the unwise soaring of prices. Cooperation during depression means loosening up and increasing these activities. And you cannot do this by legislation. The government can hinder business, but it cannot create business. Creation can be done only by the people. Cooperation does not mean the senseless and short-sighted grab for every nickel that can be squeezed out of the other fellow. It means give and take, each with a view of keeping intact the stability of the entire economic structure; not worrying so much about expansion today as about the "surability" of having prosperity a year from today.

—Glen Macomber.

The Up Grade

In reference to the choice of the technical over the shop trained man, one of the most important points has been lost sight of by our friend Bill Holland. It is well recognized that the universities and technical schools, the world over, can give an equally thorough education to the evening student and to the day student. The evening student usually takes two years longer unless especially brilliant.

The university or purely technical trained man has to scrap a lot of his theory after beginning to work, whereas the shop man, who combines theory with everyday practice, is automatically accepting or rejecting both theory and practice in shop problems. Hence I'm definitely in favor of the technical-practical man for any executive position.

—Walter R. Parkinson, *Wood Fibre, Canada.*

Itemized Pricing

From the viewpoint of the buyer, itemized pricing is to be desired. This is especially true of special machinery, some of which the buyer already uses. Special adaptions, drives, motors, and accessories can be put on by the buyer's mechanical force at lower cost.

Sometimes, by means of a sales agreement, certain parts, such as motors, can be purchased cheaper than the builder of the machine could buy and resell them. In these times, when every executive is studying every purchase to see if it cannot be bought more cheaply, itemized pricing is certain to be welcomed.

—Norman Lapp.

Dominant or Dumb?

In any discussion, each member should have sufficient self-assertion to maintain his place. If he has not enough, he will be carried along in the stream of other people's ideas. If he is too dominant, he may carry his point by riding roughshod over his weaker and possibly more logical opponents, but at the expense of much of their cooperation. Perhaps that is why few businesses succeed in making the best of the brains within their organizations.

People who are mentally lazy will suspend their comments until others have voiced theirs, and then echo some opinion already expressed. But it is better to have real convictions rather than a tolerant and kindly indifference. To refrain from expressing an opinion until everyone else has spoken may be the right course when one's object is to pass intelligent judgment on what has been presented. It requires the type of mind that is discriminating, charitable, and honest, to take all the considerations into account. Few men are so well informed they can give correct decisions all the time.

—George Laidler, *Hamilton, Ontario.*

Interference in Long and Short A

SAM TRIMBATH
Gear Consultant

IN DESIGNING long and short addendum gear teeth, to be cut with standard cutters, such as described by A. B. Cox (*AM*—Vol. 74, page 196), I would recommend that an analysis be made to determine the tooth thickness in relation to the depth of cut, with reference to the type cutter used when machining, and that the tooth thickness be specified on the working drawings. This is not always done. Quite frequently, the specifications merely give the pitch diameter as over or under the nominal diameter an amount equal to the blank increase or decrease. As Mr. Cox points out, the

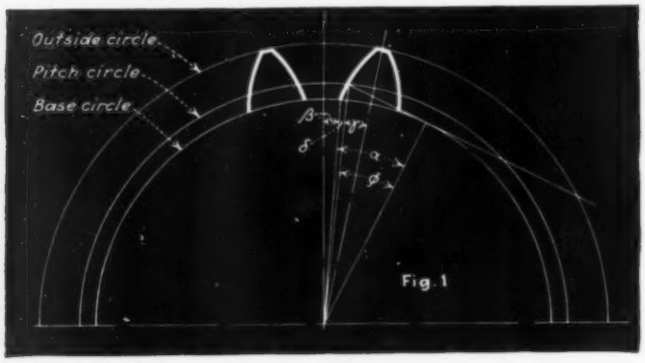


Fig. 1

pitch diameter does not change, if the number of teeth and center distance remain the same.

When the tooth thickness is specified, the work can be gaged with gear tooth vernier calipers or measured across pins placed between the teeth. For helical gears, the measurements across balls or ball pins can be determined, and the work accurately gaged in this manner.

When the tooth thickness is not specified, an alternate method of gaging would be to cut one gear standard depth and the other to fit it when rotated on correct centers. The objection to this method is that it may result in the short addendum teeth being necessarily thin and deep, if pinion-type cutters are used when machining.

As the pitch diameters are not changed, the circular pitch is the same as for standard gears of like pitch. Cutting each gear to standard depth, measured from the outside of the blank, with pinion-type cutters, may result in a combined thickness of two mating teeth greater than the circular pitch, and consequently, the gears will not operate at the correct centers.

To illustrate the above, we will take an example, where the pinion blank is made 0.200 in. large and the meshing gear blank is made 0.200 small, and compute the resulting tooth thicknesses. The same cutter is used for

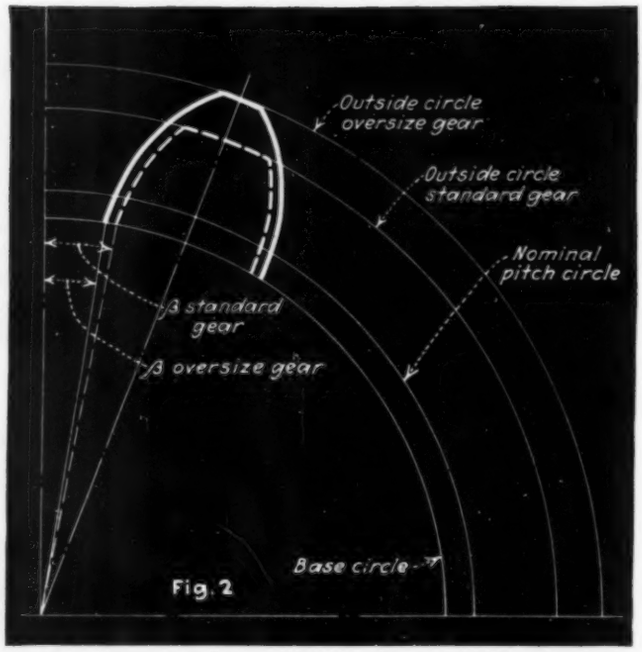


Fig. 2

both. Fig. 1 represents a 5-pitch, 15-tooth, 20-deg. pressure angle cutter, having the dimensions of a standard gear, with the exception that the outside diameter is large, to provide clearance at the bottom of the gear teeth.

Outside radius = 1.750 in.
Pitch radius = 1.500 in.
Base radius = 1.4095 in.

Angle $\phi = 20$ deg. $= 0.34907$ radians

$\tan \phi = \alpha$ in radians $= 0.36397$

$0.36397 - 0.34907 = 0.01490 = \delta$

Half the tooth thickness at the pitch circle $= 0.15708$.

$$\frac{0.15708}{1.500} = 0.10472 = \gamma \text{ in radians}$$

$$\gamma + \delta = 0.10472 + 0.01490 = 0.11962$$

$$\beta + \delta + \gamma = \frac{180 \text{ deg.}}{15} = 12 \text{ deg.} = 0.20944 \text{ radians}$$

$$\beta = 0.20944 - 0.11962 = 0.08982$$

Angle β, being formed by a line drawn through the center of a tooth space and a radius to the origin of the involute profile, may be found by referring to the accompanying table, which gives this angle in radians for all gears of standard tooth thickness, 8 to 43 teeth inclusive, and for 14½ deg., 17½ deg., 20 deg., 22½ deg., 25 deg., 27½ deg., and 30 deg. pressure angles.

When gear teeth are over or under standard tooth thickness, angle β decreases or increases. In Fig. 2, the dotted profiles represent a gear tooth of standard thickness, and the heavy profiles, a gear of like number to teeth with the outside diameter larger and teeth thicker. It will be noted that as both profiles have the same base circle, they form parallel lines. If the decrease in β is known we can determine the amount the teeth are thick.

Addendum Gears

At first thought, an increase in the pinion addendum and a like decrease in the gear addendum might appear to yield a satisfactory design. But the following analysis shows that certain pitfalls are present if the important factor of tooth thickness is not carefully considered

PRESSURE ANGLE

Teeth	14-1/2	17-1/2	20	22-1/2	25	27-1/2	30
8	0.19080	0.13648	0.18144	0.17484	0.16637	0.15575	0.14259
9	0.16899	0.16467	0.15963	0.15303	0.14456	0.13393	0.12073
10	0.15154	0.14722	0.14213	0.13557	0.12710	0.11648	0.10333
11	0.13726	0.13294	0.12790	0.12130	0.11283	0.10221	0.08906
12	0.12535	0.12103	0.11600	0.10939	0.10093	0.09030	0.07715
13	0.11528	0.11096	0.10593	0.09932	0.09085	0.08022	0.06708
14	0.10666	0.10234	0.09730	0.09069	0.08222	0.07160	0.05845
15	0.09918	0.09486	0.08982	0.08321	0.07474	0.06412	0.05097
16	0.09264	0.08832	0.08327	0.07667	0.06820	0.05758	0.04443
17	0.08685	0.08253	0.07750	0.07089	0.06243	0.05180	0.03866
18	0.08172	0.07740	0.07236	0.06576	0.05729	0.04667	0.03352
19	0.07712	0.07280	0.06777	0.06116	0.05270	0.04207	0.02892
20	0.07299	0.06867	0.06364	0.05703	0.04857	0.03794	0.02479
21	0.06926	0.06494	0.05991	0.05330	0.04484	0.03420	0.02106
22	0.06586	0.06154	0.05650	0.04990	0.04143	0.03080	0.01765
23	0.06275	0.05843	0.05340	0.04679	0.03832	0.02769	0.01455
24	0.05990	0.05558	0.05055	0.04394	0.03547	0.02484	0.01170
25	0.05729	0.05297	0.04793	0.04133	0.03285	0.02223	0.00908
26	0.05486	0.05054	0.04550	0.03889	0.03042	0.01980	0.00665
27	0.05263	0.04831	0.04328	0.03666	0.02820	0.01757	0.00443
28	0.05055	0.04623	0.04119	0.03458	0.02611	0.01550	0.00234
29	0.04862	0.04430	0.03927	0.03265	0.02419	0.01356	0.00042
30	0.04682	0.04250	0.03746	0.03085	0.02238	0.01176	0.00139*
31	0.04512	0.04080	0.03576	0.02915	0.02069	0.01006	0.00308*
32	0.04355	0.03923	0.03418	0.02758	0.01911	0.00849	0.00466*
33	0.04205	0.03773	0.03269	0.02608	0.01762	0.00699	0.00615*
34	0.04066	0.03634	0.03129	0.02469	0.01622	0.00560	0.00755*
35	0.03933	0.03501	0.02997	0.02336	0.01490	0.00427	0.00887*
36	0.03809	0.03377	0.02873	0.02212	0.01366	0.00303	0.01011*
37	0.03691	0.03259	0.02755	0.02095	0.01248	0.00186	0.01129*
38	0.03579	0.03147	0.02643	0.01983	0.01136	0.00074	0.01241*
39	0.03473	0.03041	0.02538	0.01877	0.01031	0.00032	0.01346*
40	0.03372	0.02940	0.02436	0.01776	0.00929	0.00133*	0.01448*
41	0.03276	0.02844	0.02340	0.01680	0.00833	0.00229*	0.01544*
42	0.03184	0.02752	0.02249	0.01588	0.00742	0.00321*	0.01635*
43	0.03098	0.02666	0.02162	0.01502	0.00655	0.00407*	0.01722*

Values of β (the angle between the center line of a tooth space and the radius to the involute)

In Fig. 3, the same cutter is shown in mesh with an oversize 10-tooth gear.

Outside radius of gear (0.100 over standard) = 1.300 in.

Nominal pitch radius of gear $\left(\frac{\text{number of teeth}}{2 \times \text{pitch}}\right)$ = 1.000 in.

Depth of gear teeth = 0.450 in.

Root radius of gear = 0.850 in.

Base radius of gear OE = 0.9397 in.

$1.750 + 0.850 = 2.600$ = operating center distance OO'

$\frac{1.4095 + 0.9397}{2.600} = 0.90354$ = cosine of operating pressure angle $\phi = 25° 22'$

$\frac{1.4095}{0.90354} = 1.560$ = operating pitch radius of cutter $O'C$

$2.600 - 1.560 = 1.040$ = operating pitch radius of gear OC

$\frac{1.040 \times 3.1416}{\frac{1}{2} \text{ number of teeth } (5)} = 0.6535$ = operating circular pitch or the sum of a cutter tooth thickness and a gear tooth thickness at the operating pitch circle.

$25° 22' = 0.44273$ radians

$\tan \phi = \alpha$ in radians $= 0.47412$

$0.47412 - 0.44273 = 0.03139 = \delta$ (for both cutter and gear)

As the cutter has the same tooth thickness at the nominal pitch radius as a standard gear, $\beta = 0.08982$.

$0.08982 + 0.03139 = 0.12121 = \beta + \delta$ (cutter)

$\frac{180°}{15} = 12° = 0.20944$

$= \beta + \delta + \gamma$ (cutter)

$0.20944 - 0.12121 = 0.08823 = \gamma$ (cutter)

$0.08823 \times 1.560 = 0.1376$

$= \frac{1}{2}$ cutter tooth thickness at the operating pitch circle.

$0.6535 - (2 \times 0.1376) = 0.3783$

= gear tooth thickness at operating pitch circle.

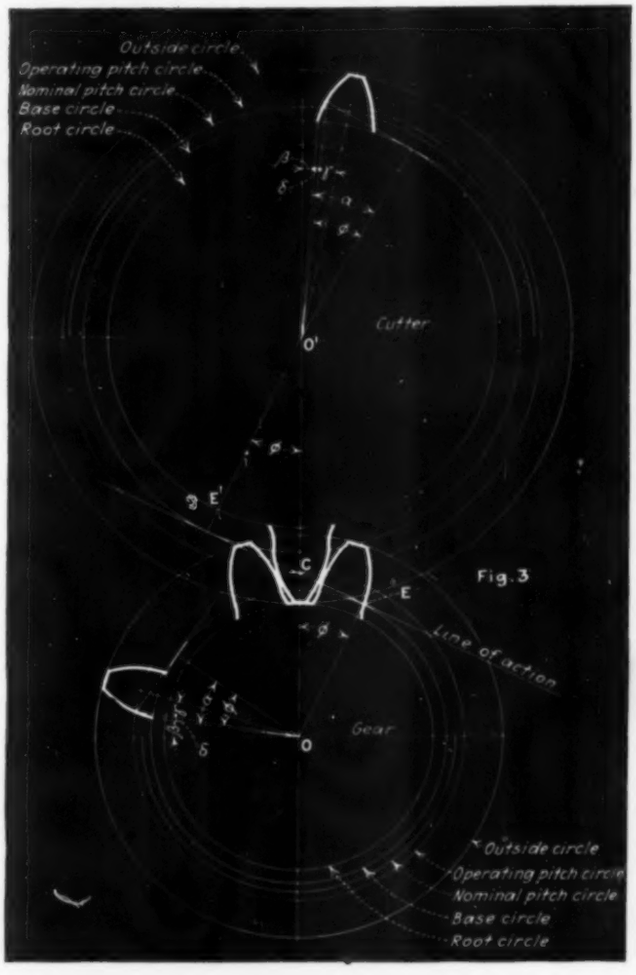
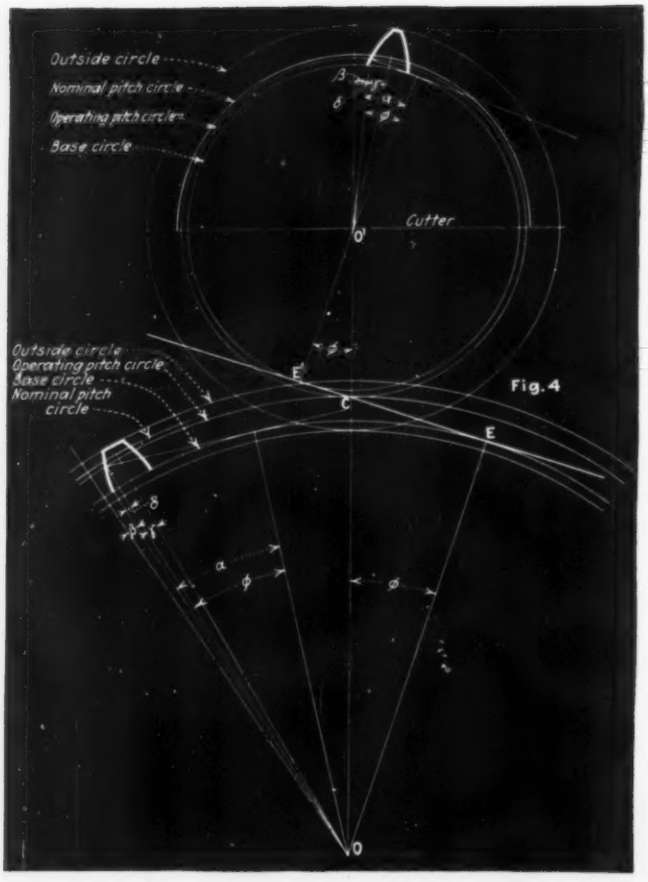


Fig. 3



$$\frac{0.3783}{2} = 0.18915$$

$$\frac{0.18915}{1.040} = 0.18188 = \gamma \text{ (gear)}$$

$$0.18188 + 0.03139 = 0.21327 = \gamma + \delta \text{ (gear)}$$

$$\frac{180^\circ}{10} = 18^\circ = 0.31416 \text{ radians}$$

$$= \beta + \delta + \gamma \text{ (gear)}$$

$$0.31416 - 0.21327 = 0.10089 = \beta \text{ (gear)}$$

From the table, β for a standard 10-tooth gear is 0.14218.

$$0.14218 - 0.10089 = 0.04129 = \text{decrease in } \beta$$

$$0.04129 \times 2 \times 0.9397 = 0.0776$$

= the amount the 10-tooth gear teeth are thick at the base radius.

$$0.04129 \times 2 \times 1.000 = 0.0826$$ = the amount the teeth are thick at the nominal pitch radius.

Fig. 4 represents the same cutter as in Fig. 3 in mesh with a 40-tooth gear whose outside diameter is the same amount under as the 10-tooth gear was oversize.

Outside gear radius	= 4.100	in.
Nominal pitch radius gear	= 4.000	in.
Depth of gear teeth	= 0.450	in.
Root radius gear	= 3.650	in.
Base radius of gear OE	= 3.7588	in.

$$1.750 + 3.650 = 5.400$$

= operating center distance $O'O$

$$\frac{1.4095 + 3.7588}{5.400} = 0.95709$$

= cosine of operating pressure angle $\phi = 16^\circ\ 51'$

$$\frac{1.4095}{0.95709} = 1.4727$$

= operating pitch radius cutter $O'C$

$$5.400 - 1.4727 = 3.9273$$

= operating pitch radius gear OC

$$\frac{3.9273 \times 3.1416}{20} = 0.6169$$

= operating circular pitch

$16^\circ\ 51' = 0.29409$ radians

$\tan \phi = \delta$ in radians $= 0.30287$

$0.30287 - 0.29409 = 0.00878$

$= \delta$ (for both cutter and gear)

$\beta = 0.08982$

$0.08982 + 0.00878 = 0.09860 = \beta + \delta$ (cutter)

$0.20944 = \beta + \delta + \gamma$

$0.20944 - 0.09860 = 0.11084 = \gamma$ (cutter)

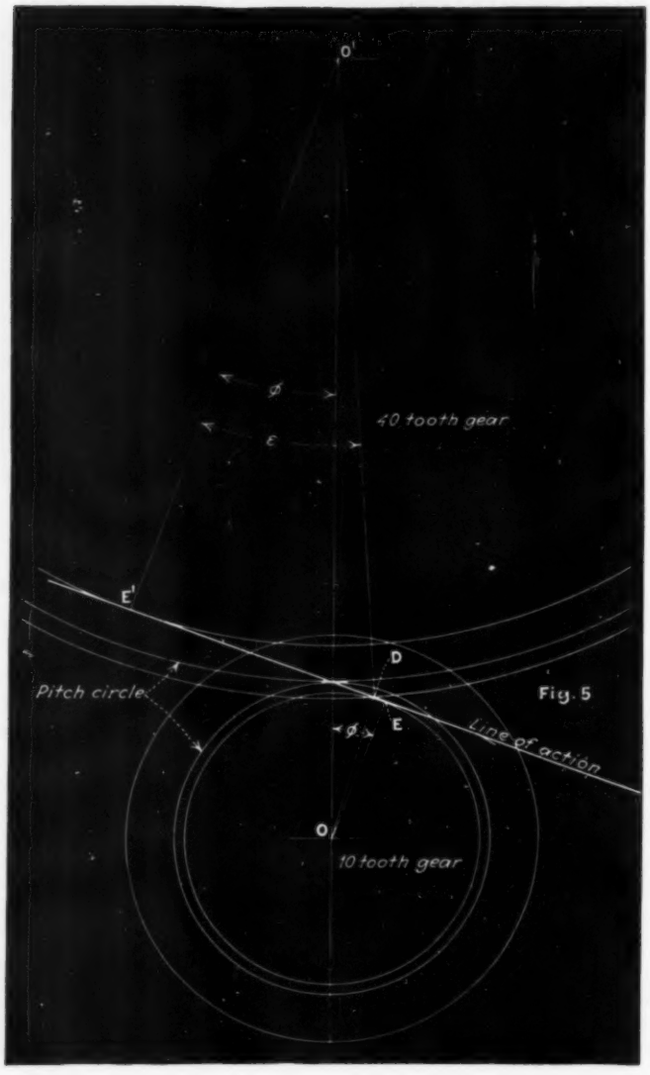
$0.11084 \times 1.4727 = 0.1632$

= ½ cutter tooth thickness at the operating pitch circle.

$0.6169 - (2 \times 0.1632) = 0.2905$

= gear tooth thickness at the operating pitch circle.

$$\frac{0.2905}{2} = 0.14525,$$



$$\frac{0.14525}{3.9273} = 0.03698 = \gamma \text{ (gear)}$$

$$0.00878 + 0.03698 = 0.04576 = \delta + \gamma$$

$$\frac{180^\circ}{40} = 4^\circ\ 30' = 0.07854 \text{ radians}$$

$$= \beta + \delta + \gamma \text{ (gear)}$$

$$0.07854 - 0.04576 = 0.03278 = \beta \text{ (gear)}$$

$$0.02436 = \beta \text{ for a standard 40-tooth gear.}$$

$$0.03278 - 0.02436 = 0.00842 = \text{increase in } \beta$$

$$0.00842 \times 2 \times 4.000 = 0.0674$$

$$= \text{the amount the 40-tooth gear teeth are thin at the nominal pitch radius.}$$

As the teeth in the above gear are 0.0674 thinner than standard and the teeth in the 10-tooth gear were found to be 0.0826 thick, the combined tooth thickness will exceed the circular pitch, and the gears will not operate at the nominal center distance of 5.000 inches. To make them do so would necessitate cutting the 40-tooth gear teeth 0.0826 thinner than standard, which would make it considerably deeper.

A much better balance in regard to tooth thickness, depth of teeth, and clearance at the bottom of the teeth could be obtained by specifying the long addendum teeth to be 0.075 thicker than standard and the short addendum teeth 0.075 thin. This is the average amount the teeth in the respective gears were found to be thick and thin at standard depth. Thus the depth of both gears is increased instead of only one.

By increasing the depth of teeth in the 10-tooth gear, we can avoid another difficulty, which is shown by comparing the length of line DE in Fig. 5 to the length DE in Fig. 6. Fig. 5 represents the 10-tooth gear in mesh with the 40-tooth gear, and Fig. 6 to 10-tooth gear in mesh with the cutter, when cut to standard depth. As involute tooth contact either begins or ends, depending on the direction of rotation, where the outside circle intersects the line of action, the length of line DE in Fig. 5 should be greater than in Fig. 6. Otherwise, the teeth in the 40-tooth gear may contact below the involute profile of the 10-tooth gear, resulting in an interference at the points of the teeth.

Referring to Fig. 5:

$$OE = 0.9397 \qquad O'E' = 3.7588$$

$$O'D = 4.100 \qquad \text{Angle } \phi = 20 \text{ deg.}$$

$$(0.9397 + 3.7588) \times 0.36397 = 1.7101 = EE'$$

$$\frac{3.7588}{4.100} = 0.91678$$

$$= \cos \text{ angle } \varepsilon = 23^\circ\ 33'$$

$$\tan \varepsilon = 0.43585$$

$$3.7588 \times 0.43585 = 1.6383 = E'D$$

$$1.7101 - 1.6383 = 0.0718 = DE$$

Referring to Fig. 6:

$$OE = 0.9397 \qquad O'E' = 1.4095$$

$$O'D = 1.750 \qquad \text{Angle } \phi = 25^\circ\ 22'$$

$$(0.9397 + 1.4095) \times 0.47412 = 1.1138 = EE'$$

$$\frac{1.4095}{1.750} = 0.80543 = \text{cosine angle } \varepsilon$$

$$= 36^\circ\ 21'$$

$$\tan \varepsilon = 0.73592$$

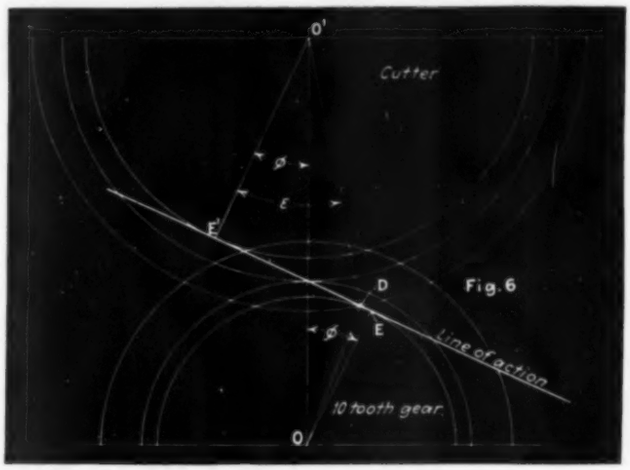
$$1.4095 \times 0.73592 = 1.0373 = E'D$$

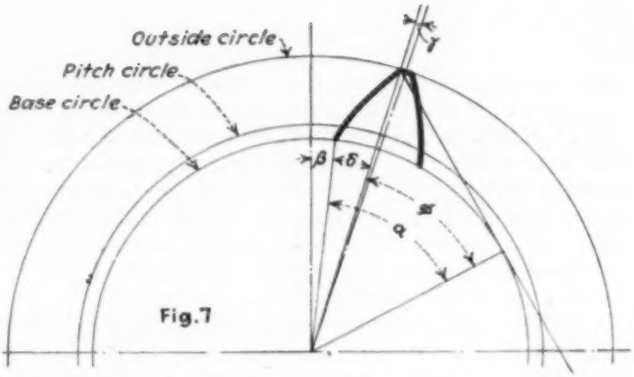
$$1.1138 - 1.0373 = 0.0765 = DE$$

In the above computation, the outside radius of the cutter was used for $O'D$ when determining $E'D$. Actually $O'D$ should have been reduced in this computation to allow for a small corner break on the cutter. This would make the length DE for the cutter and the 10-tooth gear even greater.

In practice, the outside radius of the cutter is reduced when sharpened. As a result center distance $O'O$, operating pressure angle ϕ, and length DE vary, being greatest when a cutter of maximum diameter is used. For this reason, when computing the center distance $O'O$, the maximum diameter of cutter (which is usually greater than for a gear of standard outside dimensions plus twice the clearance) should be used.

In decreasing the length of line DE, Fig. 6, by





increasing the depth of cut, care must be taken to see that the teeth do not become pointed and that the width of land at the tops of the teeth is sufficient. Referring to Fig. 7, which represents a 10-tooth, 5-pitch, 20-deg. pressure angle gear, with teeth 0.075 thicker than standard:

$$\text{Outside radius} = 1.300$$

$$\text{Base radius} = 0.9397$$

$$\beta \text{ normal} = 0.14218 \text{ radians}$$

$$0.03575 = \tfrac{1}{2} \text{ the amount teeth are thick}$$

$$\text{Nominal pitch diameter} = 1.000$$

$$\frac{0.0375}{1.000} = 0.03750 = \text{decrease in } \beta$$

$$0.14218 - 0.03750 = 0.10468 = \beta \text{ (actual)}$$

$$\frac{0.9397}{1.300} = 0.72285 = \cos \text{ angle } \phi = 43^\circ\ 43'$$

$$= 0.76300 \text{ radians}$$

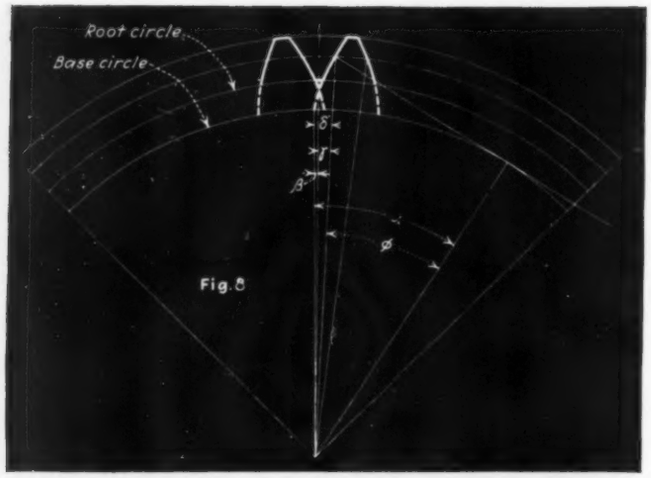


Fig. 8

$$\tan \phi = \alpha \text{ in radians} = 0.95618$$
$$0.95618 - 0.76300 = 0.19318 = \delta$$
$$0.19318 + 0.10468 = 0.29786 = \delta + \beta$$
$$\beta + \delta + \gamma = \frac{180^\circ}{10} = 18^\circ = 0.31416$$
$$0.31416 - 0.29786 = 0.01620 = \gamma$$
$$0.01630 \times 2 + 1.300 = 0.0424 = \text{width of land at tops of gear teeth.}$$

Should the width of land prove insufficient, the alternatives are either to reduce the outside diameter or to specify special cutters that will increase the gear tooth thickness sufficiently, and at the same time, cut to a depth that will make *DE*, Fig. 6, shorter than *DE*, Fig. 5.

When using the table of radians for angle β, it will be noted that an asterisk (*) appears opposite some figures in the 27½ deg. and 30 deg. column. This indicates that the origin of the involute is on the opposite side of a line drawn through the center of a tooth space from that shown in Fig. 1. In Fig. 8, which represents a 40-tooth, 5-pitch, 30-deg. pressure angle gear:

$$\phi = 30^\circ = 0.52360 \text{ radians}$$
$$\tan 30^\circ = 0.57735 \text{ radians}$$
$$0.57735 - 0.52360 = 0.05375 = \delta$$
$$\frac{90^\circ}{40} = 2^\circ\,15' = 0.03927 = \gamma$$
$$0.05375 - 0.03927 = 0.01448 = \beta$$

An increase in tooth thickness means an increase in angle β, when the last-named conditions prevail.

The advantages of long and short addendum gears are such as to attract the designer wishing to adopt a highly efficient drive. In specifying them, however, he must not overlook the effect on tooth thickness if trouble is to be avoided. The examples given above illustrate the necessity for this and indicate a means for analyzing similar problems.

Obsolescence and the Tool Builder

OBSOLESCENCE is a word used rather glibly and ambiguously in discussing the relative efficiency of plant operation. Assuming that the actual productive capacity of a plant is sufficient to take care of the peak load of production, obsolescence becomes securely tied up with cost reduction. Because, generally speaking, the machine tool industry is possessed of a productive capacity calculated to take care of the demand for tools required during the World War, it is safe to assume that the value of modernization to our industry consists almost exclusively in lowered costs.

Our fight against obsolescence may perhaps be broken down into four classifications: (1) the acquisition of the newest and most modern equipment; (2) the modernization of the factory management and control; (3) the acquisition of new equipment to make possible the proper flexibility of production and control made necessary by the newer and more complicated machines being produced; (4) the proper design of a product permitting economical manufacture.

The first classification operates almost entirely toward the reduction of productive labor on a given operation. There are several indirect gains such as shorter processing time which reduces inventory and control expense; but the greatest gain comes in saving direct labor. The productive labor item is not the greatest part of factory cost, but perhaps is the most important as it actually governs the unit on which all cost is based. It may possibly be stated that the productive labor percentage of factory cost will range among the various plants in this industry from 15 per cent in the most efficient to about 35 per cent in the less efficient. It should be also admitted that companies making products nearly all of which are built entirely special may have somewhat different ratios. Assuming that these ratios are conservative and approximately correct, a maximum saving of 20 per cent of factory cost would appear possible by installing the most modern productive equipment. As an effort has been made to take the widest possible difference between efficient and less efficient operation, it appears safe to assume that the possible savings would probably be some amount less than 20 per cent. When it is realized that 20 per cent of the factory cost represents only about 12 per cent of the total cost, it is apparent that although the savings are of sufficient magnitude to be very important, it is more or less limited in actual amount. It may also be seen that very careful consideration must be given to the choice of new tools.

This industry generally manufactures in comparatively small lots, and makes only a small number of each unit per year. It is necessary to choose equipment of sufficient flexibility to perform operations on a variety of work. This, of course, is important so as to insure new equipment being kept in operation the maximum number of hours per year. Of greatest importance, however, comes the decision as to whether or not the possible dollar savings in cost over the old method, permit the proper interest and depreciation charges on the new equipment to be paid and still leave a fair return by lowered cost per piece.

There is a good deal of evidence available supporting the contention that in many cases it is better to utilize a certain amount of old equipment in this industry rather than have only new machines. There are many cases where the use of a limited single purpose machine is advisable. Frequently a machine of this type is in use

only a small percentage of this possible time. In these cases it is obviously cheaper to use somewhat more direct labor to complete the operation than it would be to carry the high charges that would have to be absorbed on a new tool. In other cases it is sometimes advisable to utilize a slower machine already on hand when this machine can be placed in a position where it will save a considerable amount of handling or trucking from one department to another and yet be in use only a small number of hours each year.

American Machinist, and subsequently the National Machine Tool Builder's Association, gathered data to show that about 60 per cent of the equipment in this industry is more than ten years old, and have proposed that this 60 per cent should be replaced in order to make this industry entirely efficient. It would be very interesting to be able to have this report augmented by figures showing which of the machine tools listed were normally operated over 80 per cent of full time.

It is well known that this industry suffers more than most from the wide variations of demand for its product. In good times the demand far exceeds the supply; in bad times there is virtually no demand at all. It would appear the economical way to equip is to be efficiently tooled for a fairly high normal business, but to depend on surplus equipment, not necessarily the newest, for the comparatively short peaks of demand.

There appears to be another factor of importance concerning the actual replacement of so-called obsolete equipment. On most occasions where a new machine is installed along side an old type, the new machine will perform its operations very much faster than the old. However, very frequently the operator on the old machine, stimulated by the time made on the new machine, will materially better his time, and consequently greatly reduce the profit shown on the new machine. This thought develops into the possibility that in many of the smaller industries where the opportunity for single and continuous operation machines does not exist, a tendency develops that prevents using the existing equipment with maximum efficiency.

Percentage Might be Changed

The main effort in these examples has been to bring out the thought that it is not a cut and dried fact that the machine tool industry is in dire need of replacing a large percentage of its equipment. First, if the percentage of tools normally used 80 per cent or more of full time were considered, it is possible that the percentage figures as stated in the report might be considerably changed. Second, the desirability of having a certain number of single purpose machines available for short periods of operation where a new tool could not justify itself makes economical the use of old equipment. Third, the careful study of shop operations will show many cases where the adequate and efficient use of old equipment will result in such increased production that apparently justified replacements prove uneconomical. In any replacement program it appears that these factors must be given due consideration before it would be possible to state that it is unsound to operate any tool that is over ten years old. Any replacement program which considers these factors and still shows the need for new equipment should be taken as sufficient evidence that new tools are required at the earliest possible moment.

The second major problem in plant modernization consists in having a factory management that is up-to-date and competent to take care of the many and varied problems that now exist in manufacturing. The savings and competent to take care of the many and varied probsavings in overhead and reduction of time in process and consequently of inventory. Overhead consists of from 30 to 50 per cent of factory cost. It can be seen that this is the largest factor in cost, and consequently very large possibilities for economy exist here. The proper arrangement of the factory facilitating proper control and synchronization of production alone can effect very large savings. The careful investigation of efficient use of personnel can show many economies. The utilization of the cost system not only to show cost of goods manufactured, but also to give useful data to the factory management is an outstanding example of modern scientific industrial management. Perhaps the greatest aid in control comes by replacing the old fashioned haphazard financial control with a modern budget system.

More Flexibility Needed

The third major problem is the acquisition of new equipment made necessary by new product designs and the necessity for more flexible equipment as newer and more complicated products are introduced. These changes are forced and the new equipment is required of necessity. However, this factor is always at work in keeping a plant modern.

The fourth major problem concerns engineering exclusively. The modernization of engineering practice can effect enormous savings. The standardization of material, both as to type and size, can greatly reduce inventories. The development of standard parts such as screws, collars, nuts, studs, handles, etc., that can be used on all products will make possible considerable savings. Perhaps of greatest importance is the careful training of the Engineering Department to design machines and pieces that can be economically manufactured with a minimum of jigs and fixtures.

The machine tool builder might well be called an "idealist" in industry. His great goal has been the saving of time for his customer. In so doing it is not improbable that the keeping of his own house in order has suffered. Obsolescence of equipment and of organization has slipped in because the main consideration is always—"What will our machine produce?"

The machine tool industry must become more "Profit Conscious" if it is going to exist. In order to become this it must put its house in order. Now, when orders are at very low ebb, is the time to formulate plans for this, and to prepare the way for more efficient operation. The question becomes not so much one of buying new equipment as it does one of utilizing every possible means of reducing cost. If this industry will energetically attempt to become "profit conscious" and insist that it is entitled to a fair return for its efforts, obsolescence is on the wane.

The author is a machine tool builder who prefers to remain anonymous.

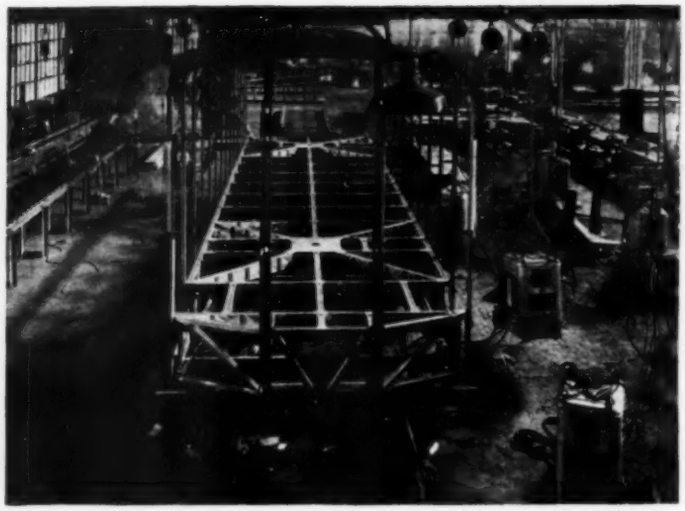
•

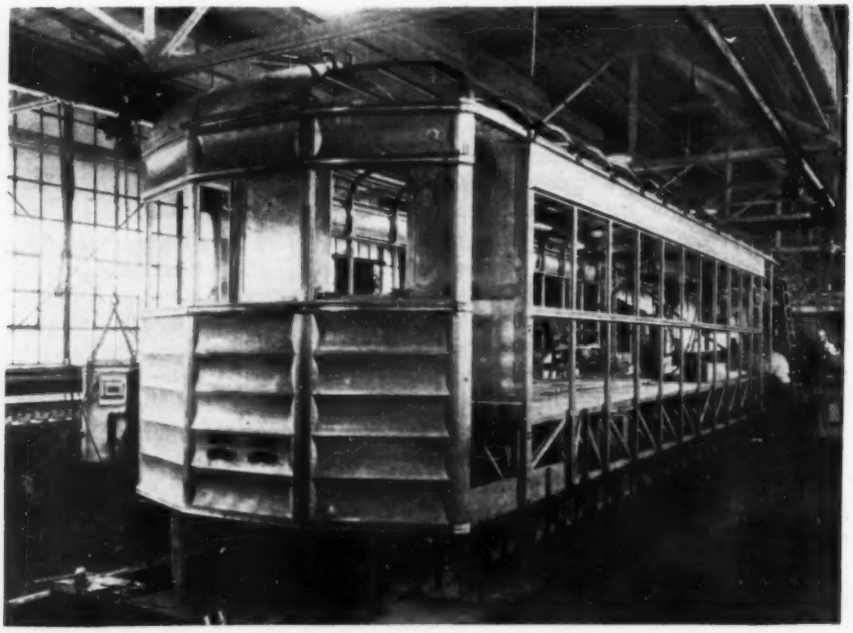
Machining an Aluminum Piston—*Correction*

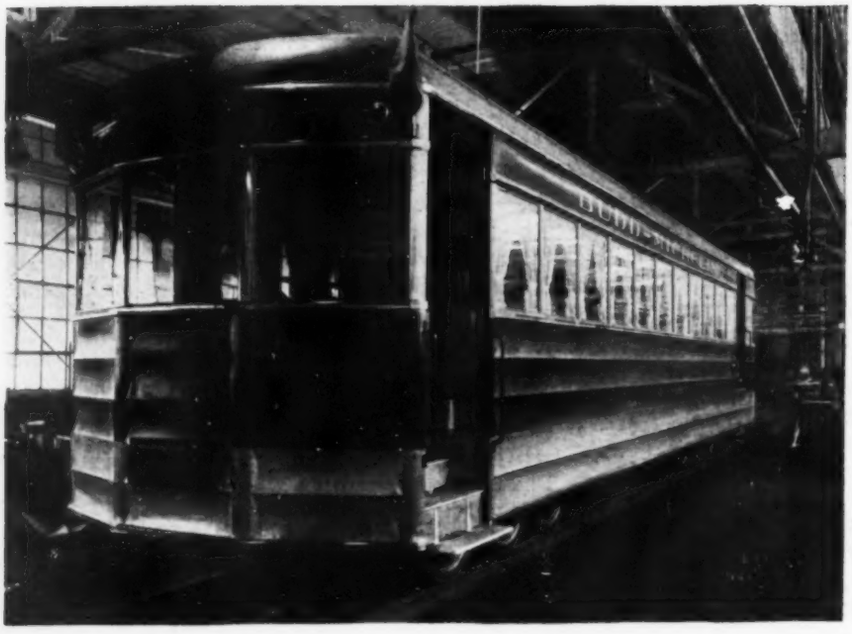
THE ILLUSTRATION on page 264, Vol. 76, showing the first position in a Baird six-spindle chucking lathe was inadvertently turned 90 deg. in printing. The machine, which appears vertical, is in reality of the horizontal type.

Shotwelding the Budd-Micheline

Stainless successfully spotwelded, extreme light weight, pneumatic-tired wheels — all these mean changes in rail-car shop practice





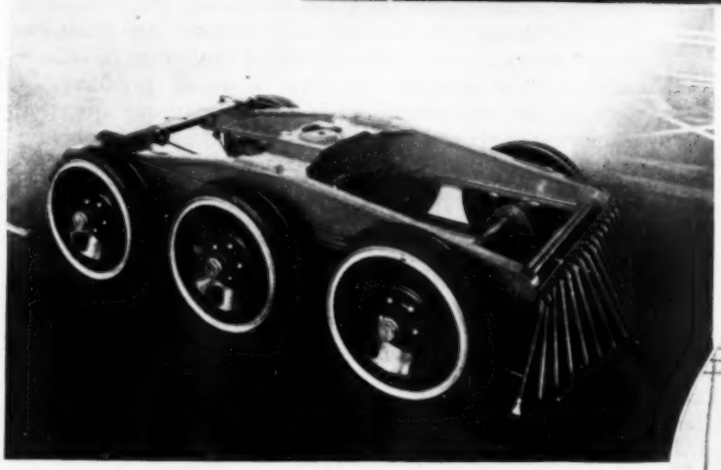


WHEN we announced, several months ago, completion by Edward G. Budd Mfg. Co. of the first all-stainless "shotwelded" airplane, readers coupled caustic comments on our "obvious proof error" with requests for further information about the process—for all previous efforts to spotweld stainless have resulted in greatly decreased corrosion resistance. But now Budd has completed a radically new type of railcar, also shotwelded, here pictured together with the equipment that fabricates it.

Shotwelding is spotwelding under highly accurate current, time and pressure control. But it has several radical features. Instead of taking the work to a spotwelding machine, the operator carries a pair of tongs, each lip of which forms one electrode. A helper just ahead of him clamps the sections together with a pneumatic clamp. The welder applies his tongs, the cables attached to them leap and writhe with the surge of the current—and the weld is complete. The secret is high current—in one case 1,200 amp.—which acts so quickly that the metal does not have *time* to lose chromium. A time switch, acting on the same principle as the automatic center punch, may be set to vary the time of current application from 0.01 to 0.001 second—no matter how long the welder holds his tongs on the weld. Cables from the welder's tongs extend to one of the portable transformer boxes that can be seen above at the right of the car frame.

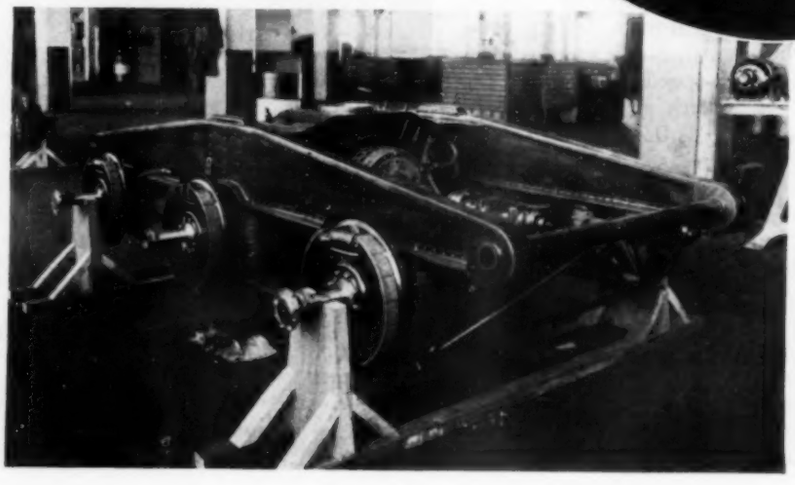
As far as weld strength is concerned—it is at least as strong as the parent metal, for finished welds will stand a 90-deg. twist before parting, or a jerk that tears out the spot.

The shotwelding may be plainly seen in this automotive-type structure, formed of 0.030-in. sheet. Some exterior sheathing is but 0.010 in. thick, yet the completed car has the structural strength of a Pullman. A total weight of 13,500 lb. compared with the conventional 140,000-210,000 lb., permits electric gasoline, Diesel, or gas-electric drive



Forward 6-wheel truck, riveted from carbon steel, with demountable disk wheels carrying 30x3-in. tires inflated to 85 lb. An inner wooden liner prevents steel inner flange from riding fishplates in case tire is deflated. Minimum tire life, 20,000 miles; rubber-to-steel contact means faster acceleration

The finished 40-passenger air-conditioned car, 41 ft. 8 in. long, 8¾ ft. wide, 10½ ft. above the rails, with a body weighing 6,341 lb., motive power 1,600 lb., drive truck 2,879 lb., idler truck 1,931 lb., miscellaneous parts 797—total without load 13,549. Non-shatterable glass, block-signal operating shoes, window heating and wiping equipment, provide safety even at speeds from 45-60 m.p.h.



The drive truck, showing rubber compression-type springs, internal expanding automotive type brakes, and riveted frame—plenty of work for the fabricating and press shops. Eight wheels use Bendix-Westinghouse air brakes, four have hand-operated emergency brakes, providing a full stop from 60 m.p.h. in 400 ft. Without crew, the car costs 10¾ cents per mile to run

Metallurgy Progresses

Being abstracts of papers presented at the 141st meeting of the American Institute of Mining and Metallurgical Engineers

MECHANICAL PROPERTIES of many metals and alloys hitherto inferior to those of steel may now be brought up to steel's standard, according to Dr. Paul D. Merica, vice-president of the International Nickel Company, in his lecture before the Institute of Metals Division, American Institute of Mining & Metallurgical Engineers, during the organization's 141st meeting in New York Feb. 16-19. Many non-ferrous metals have better corrosion resistance and electrical conductivity than steel, but were until recently mechanically inferior to steel and could not be improved by heat-treatment. During the past ten years, however, the metallurgist's power to apply heat-treatments usefully in the hardening of non-ferrous metals has been substantially broadened through his understanding of the basic principles of "age" or "precipitation" hardening. All common metals may now be alloyed to make them susceptible to age-hardening, copper for example being hardenable to about 400 Brinell, the hardness of spring steel. Copper-nickel alloys can be heat-treated to obtain strengths of 175,000 lb. per sq.in., comparable with the strength of heat-treated steel. After certain heat-treatments, these alloys harden as they grow older, sometimes at temperatures as low as 70 deg. F. The hardening is caused by generation, or precipitation, throughout the metal or alloy of a host of extremely fine, sub-microscopic particles of a hardening constituent. This flock of fine particles—each less than 0.00001 in. in diameter—is uniformly distributed throughout the mixture and hardens it.

Effect of Vanadium

The "Effect of Vanadium in High-Speed Steel" was discussed by A. B. Kinzel and C. O. Burgess, chief metallurgist and metallurgist respectively of Union Carbide & Carbom Research Laboratories. They concluded that vanadium improves cutting efficiency of the 18-per-cent W, 4-per-cent Cr high-speed steels if carbon content is properly controlled. With standard 18-per-cent W, 4-per-cent Cr, 1-per-cent V, 0.70-per-cent steel as a base, the carbon should be increased approximately 0.2 per cent for each 1 per cent increase in vanadium for optimum forgeability and cufting efficiency. Five-per-vent V with 1.5-per-cent C appears to be a satisfactory composition for 18-per-cent W, 4-per-cent Cr high-speed steels with good forgeability and improved cutting properties. Lathe tests the authors ran, with constant speed of 118-120 ft. per min., $\frac{1}{8}$-in. cut and 0.040-in. feed, gave standard high-speed steel a length of chip before failure of 2,298 in., while with the V increased to 5 per cent and the C to 1.5 per cent gave a chip length of 4,080 in. under the same conditions. Vanadium and carbon increased in proper ratio improved the cutting efficiency of cobalt high-speed steel also, with no appreciable falling off in toughness.

Heat-Treating Stainless Iron

Stainless iron, as mild stainless steel is usually called, an alloy ranging from 11.5 to 15 per cent Cr with C under 0.12 per cent, has been considered as not appreciably affected by heat-treatment. It has, consequently, failed in many applications from "mysterious" causes such as inherent lack of corrosion resistance or electrolytic effects, when the real difficulty lay in improper heat-treatment. Clarence G. Merritt of the Atha Works of Crucible Company of America, discussing the "Effect of Heat-Treatment on Corrosion Resistance of Stainless Iron," shows a variety of degrees of corrosion resistance ranging from excellent to very poor—all produced by varying the heat-treatment. His conclusions are that tempering at about 1,000 deg. F. from the as-quenched or as-rolled condition produces marked susceptibility to corrosion and weakness in impact in stainless iron. This is accompanied by lower hardness, weakening in proportional limit, and general breakdown of the metal. Tensile properties and corrosion resistance are excellent when the metal is tempered either above or below this susceptible range. Partly hardened or as-rolled steel is likely to be subject to attack unless tempered at 1,100 deg. F. or higher.

Pressure Welding

C. R. Austin, section engineer, Research Laboratories of Westinghouse Elec. & Mfg. Co., and W. S. Jeffries, Research Laboratories, National Tube Co., presented a paper on "Pressure Welding of Low-Carbon Steels with Theoretical Consideration on the Mechanism of Such Welding." These authors found it necessary first to define "welding," for their experiments showed that many bars gave high tensile values when pulled, yet finally broke exactly across the weld, showing a poor joint. They define "true welding" as "a form of intimate contact between metal surfaces so that the units lose their

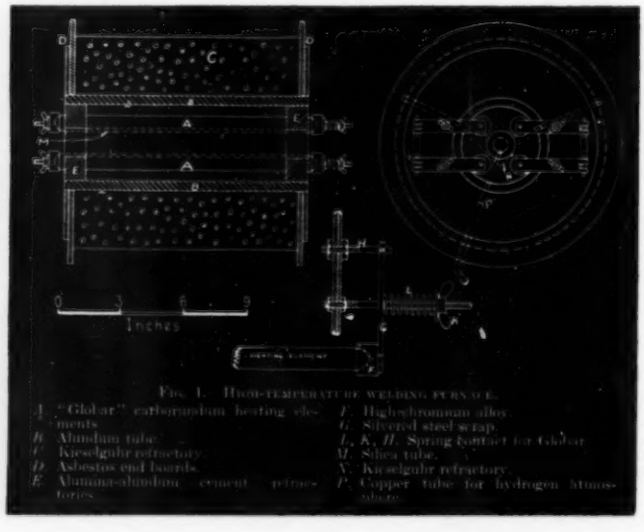


FIG. 1. HIGH-TEMPERATURE WELDING FURNACE

A. "Globar" carborundum heating elements
B. Alundum tube
C. Kieselguhr refractory
D. Asbestos end boards
E. Alumina-alundum cement refractories
F. High-chromium alloy
G. Silvered steel scrap
I, K, H. Spring contact for Globar
M. Silica tube
N. Kieselguhr refractory
P. Copper tube for hydrogen atmosphere

individual identity and there is no change in physical properties in passing through the weld from one unit to the other." The authors also developed a small high-temperature furnace for their tests, since none was commercially available. An electric resistor type attained operating temperatures of 1,400 to 1,450 deg. C. The furnace was so arranged that the heated bars could be welded within it, in order to lose no heat in the operation.

Results were similarly surprising. Often, where microexamination showed a good weld, the break actually showed a poor one—some breaks still showing lathe marks. They found that poor welding was usually the result of oxide film interference. If one bar were first rubbed on the other to remove this film, tensile results were markedly bettered. Welds in hydrogen atmosphere showed marked improvement over those in air.

Their results prove conclusively that at temperatures of 1,400 deg. C. welding can take place without the application of pressure and without perfect initial contact between the surfaces; lack of welding is not due to lack of pressure, but to an interfering film. The important conclusion is that simple pressure welding in air cannot produce good welds. Close perusal of the original paper will repay any reader.

Rust-Resisting Alloys

Announcement of a discovery that certain iron-aluminum alloys are markedly resistant to rust at high temperatures was made by Nicholas A. Ziegler of the Westinghouse Electric and Manufacturing Company. This discovery, it was stated, is an important step toward the elimination of rust in electric furnaces and other machinery, which will mean the saving of millions of dollars each year in industry.

The X-ray has solved the secret of what happens when one metal dissolves into another like sugar in water, it was stated in a paper by Prof. Wheeler P. Davey and Dr. R. T. Phelps, of Pennsylvania State College. The disappearance of one metal in another, they found, is due to a chemical combination between atoms of the disappearing metal and the surrounding atoms of the dissolving metal. The X-ray studies were made upon aluminum dissolved in silver.

Machinability of Brass

Alan Morris, research engineer of Bridgeport Brass Co., reported the results of his experiments on the "Machinability of Free-Cutting Brass Rod." He used a testing apparatus of the single-tooth milling cutter type, composed on an ordinary milling machine in which a heavy pendulum has been substituted for the pulley on the arbor. If the pendulum is raised to any given height and allowed to fall freely, it will rise to almost the same height at the opposite end of the swing. A pointer is carried around by the pendulum and remains at this end point to indicate on a dial the angle through which the pendulum has risen. If the sample is brought into position so that the tool, as it is carried around with the pendulum, will make the desired cut, and the weight is allowed to fall from the same height as before, it will rise to a lesser height due to the resistance of the sample to the cutting tool. The difference between these two heights, multiplied by the mass of the swinging pendulum, is a measure of the energy consumed in making the cut. The sample, after being weighed, is adjusted on the machine table so that the cutting tool edge just touches its upper surface. The pendulum is then retracted, the sample elevated 0.20 in. and the pendulum dropped. Six cuts of this sort are taken, the tool cutting in a new spot each time. The sample in then weighed again to determine the weight of metal removed, which multiplied by the sample's specific gravity, gives volume of metal removed. Total energy consumed in making the cuts, divided by volume of metal removed, gives energy consumed in removing a unit volume of metal. All cuts were made without lubrication.

Mr. Morris' results show that the machinability of muntz metal improves rapidly with small additions of lead, but much less rapidly as the lead content increases. Within the range of 60.0 to 63.5 per cent the effect of copper content is small. The machinability of annealed leaded brass rod is improved by cold drawing after annealing. His tests indicate that tensile properties cannot be expected to indicate machining qualities of a rod.

Gases in Metals

Troubles occur if metal parts used in the manufacture of vacuum tubes are not thoroughly "degassed." Metals such as molybdenum must be heated to a high temperature in a high degree of vacuum in order to expel all of the gas. Experiments conducted by Dr. F. J. Norton and Dr. A. L. Marshall of the General Electric Laboratories show that the gas is present throughout the thickness of the metal, not simply clinging to its surface. No matter what the commercial source of "moly," for example, they found that the gas was still present. Molybdenum parts must be heated to 1,700 deg. C. (3,200 deg. F.) in a vacuum of the order of a tenth of a billionth of atmospheric pressure, and maintained at that temperature for a length of time depending upon the thickness of the metal, to remove all gas. The piece may then be cooled and assembled in air, the gas picked up during the process simply being a monomolecular surface layer readily removable.

NEXT WEEK

There have been times during the past couple of years when rate-setting seemed destined to become a lost art—like hardened copper and ancient Japanese sword making. But as business strikes its stride, rate-setting returns to its own. Quicker, more accurate methods become the order of the day, and it is up to us to keep you in touch with the best of them. In the next issue, therefore, you can look forward to the first installment of a genuinely practical series on the subject.

Subject to last minute changes without notice, you can also look forward to articles on the following subjects: cutting down the patent budget; plating in a laboratory shop; radio ultra-micrometers for the shop; press tools for manufacturing bezels; welding in the fence industry; small tool grinding (second installment); graphical determination of both blank diameters and blanking pressures.

IN A. M.

Equitable Distribution of Wages by Man Rating

CHARLES B. GORDY
Assistant Professor,
Department of Mechanical Engineering,
University of Michigan

A WELL CONSIDERED system of wage payment will take into consideration many factors in addition to the worker's output. Management, in this way recognizes that a workman's worth is shown by his all-round performance. Moreover, loyalty and morale may be developed by such individual treatment and consideration. The necessity for individualized treatment is especially pronounced in cases where a group bonus method of wage payment is used. In such cases a group of men are cooperating in a common effort to produce a certain result, the scheduled output of okay pieces at the end of the line. Different capacities and different characteristics among the workmen making up the group affect the result, and management should attempt to differentiate in the wages paid for these varying contributions.

The Oakland Plan

The Oakland Motor Car Company has developed a plan which recognizes these differences and rewards accordingly. With men working in a production line, and with a range in hourly rates of from 50 to 58 cents, let us say, per hour, it becomes a matter of importance to distribute this range of rates justly between these men in accordance with their individual contributions. Furthermore, in a large organization, it is necessary to distribute rates uniformly throughout the various divisions of the company. In this way only can equal skill, effort and all-around performance be uniformly rewarded.

This man-rating plan is based upon the following seven qualifications for a good workman:

1.	Does he do good work?	25 Maximum rating value.
2.	Does he do his share?	20 Maximum rating value.
3.	Is he a clean, orderly and safe worker?	15 Maximum rating value.
4.	Is his attendance regular?	10 Maximum rating value.
5.	Does he work well with others?	10 Maximum rating value.
6.	Does he follow instructions willingly?	10 Maximum rating value.
7.	Does he work from whistle to whistle?	10 Maximum rating value.

Each foreman is given a rating book, with a sheet for each workman upon which are printed the above seven characteristics with appropriate spaces for the marking of daily merit ratings.

The fundamental basis of rating, as far as the foreman is concerned, is that the best man in the department is to receive the full value of the point rating. The foreman is not asked to use any theory as to perfection in his ratings. For instance, if a man is given a rating of 25 on the rule, "Does he do good work?" that does not mean that he does perfect work. Giving a man, such as a milling machine operator in the cylinder block department, a rating of 25 points for this rule means that he is the best man in the department. He may even have two or three demerits for spoiled work. However, if the next best man had five demerits for spoiled work, he would be penalized by a lower point rating for his extra demerits. Each demerit is given the value of one-half a point.

Daily Ratings

The following quotation from the book of instructions given all employees further elaborates the plan:

"In this plan of rating, your foreman will rate you daily and monthly on each of these classifications. This system is to be fair and you may ask your foreman at any time and discuss with him the reasons for the rating he has given you as well as how you may improve your rating.

"Your rating card becomes a part of your employment record and your monthly rating is considered in times of layoffs, rehires and also assists the management in determining your status regarding change in wage rates and transfer to better jobs."

At the end of each month the workman is required to sign his rating card. While it is necessary for the foreman to inform his workmen at the time, why, and for what, a demerit is given, this monthly check-up informs each workman of his exact standing. Continued low rating results in an interview with the superintendent, when the entire situation is covered and evaluated. The workman is given a month in which to correct the faults responsible for his low rating. In the event that such corrections are not made, the hourly rate will be reduced. When a workman continually receives a high rating, this forms the basis for an increase in the base rate at re-rating periods.

Results of the Plan

Beneficial results have accrued from the use of this plan. The worker's worth and standing become a matter of record on his employment card; he is an individual to his foreman and to the management. At times of lay-off, rehiring or re-rating periods, management has a simpler task than heretofore, due to these estimates of all-around worth. It has been found also that disciplinary measures have tended to disappear due to the workman's constant awareness of the fact that his actions are matters of daily evaluation.

IDEAS FROM PRACTICAL MEN

Simple Balancing Equipment

A. W. FORBES
Forbes & Myers

IT WAS found that some of the parts of our frequency changers did not fit the balancing equipment available. There was no cylindrical part of the shaft long enough to fit the bearings of the balancing machine, and the fans projected so far that there was danger that they might catch on the driving belt. It was necessary either to take off the fans for balancing, which sometimes made trouble with the balance when they were put on again, or to make special shaft extensions just for the balancing operation. In this case, the fit of the extensions was not always perfect, as there was but a short piece of shaft to attach them to in proportion to the length of the extension. The result was that a few machines got out that were not balanced any too well.

Fig. 1

So it was decided to build new equipment for balancing, and the simple arrangement shown in Fig. 1 was arranged to fit an old lathe. The work is rotated on centers made in accordance with Fig. 2. The only other part of the equipment is a motor and a belt to drive the work. A hole is drilled and reamed in each of the ordinary centers, and a small, loose center is inserted in the hole. The inner end of the loose center bears against the rounded end of a hardened plug at the bottom of the hole and is prevented from rotating by a pin. A rest, on which the operator rests his marking tool, is attached to the outer part of each regular center. Both of the small centers must be loose so that they can vibrate freely as the work rotates, and so indicate the heavier side. If a rotor is rotated on ordinary centers, the vibration of the heavier side will be transmitted to the lathe and through the lathe to the opposite end of the work, so that indications will be confused by other vibrations. On the loose centers, each end of the work will vibrate separately, showing which end is the heavier and the more out of balance.

When the rotor is stationary on the centers, the loose centers will naturally rest on the undersides of the holes. As the rotor is turned, the heavy side of the work will tend to raise the loose center by centrifugal force, and a mark placed on the rotor will show the heavy side. Later, as the rotor continues to speed up, the mark is no longer to be found on the heavy side, but eventually gets around to the light side. To get the most sensitive action, particularly at low speeds, it is sometimes desirable to lift the loose center a little with the hand while marking.

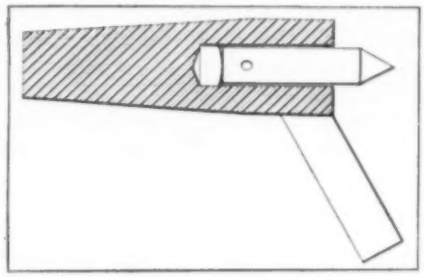


Fig. 2

The side of the shaft that runs out is marked in the usual way. Theoretically, the bearing seat should be marked, since when the bearing runs true on the balancing machine, the rotor will run true in the bearings. With this construction, it is usually possible to mark both bearing seats at one setting.

The countersunk center holes on which the part to be balanced rotates should be concentric with the bearing seat, and in a new machine they are. With old repair jobs, the shaft may be sprung or the center holes may be damaged. It might be thought that this would throw the balance out badly, but actually a slight injury to the center hole does no harm, for the bearing seats run practrically true when the rotor is in balance, even if the centers are vibrating. The centers are so small in diameter and so light in weight that a little motion of them does not affect the mass of the rotor enough to decrease appreciably the accuracy of the process.

Theoretically, the driving motor should be placed either directly over or directly under the part to be balanced, with a vertical belt connecting them. The marking would then be done in front and at right angles to the belt. Either of these positions would prevent vibration from the belt affecting the marking. Actually, we have not been able to discover any effect from the driving belt, for the belt does not give any vibration in

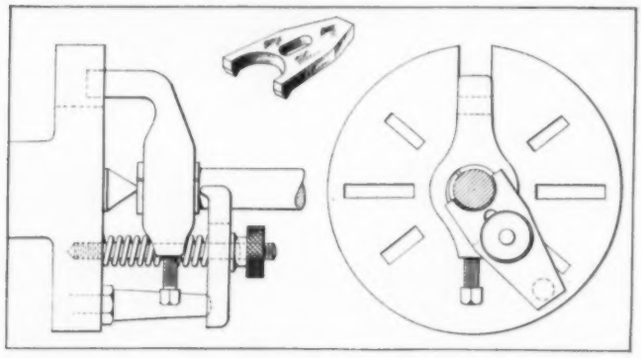
time with the rotation of the shaft; so the motor can be placed in the most convenient location.

For our work, we like this arrangement better than the dynamic balancing machines that we have seen. But we would particularly recommend it for the plants that have little balancing to do, and that have considered the cost of dynamic balancing machines to be too great. We would have had dynamic balancing equipment years before we did if we had known how easily it could be made. There are doubtless many others who are sending out units that would be better if dynamically balanced.

Holding Steadyrested Work Against the Live Center

BERNARD THOMPSON
Birmingham, England

Where work is supported by the steadyrest, the illustration shows a satisfactory method of holding it against the live center. The work is driven by an ordinary dog in the usual manner, but to prevent its being marred



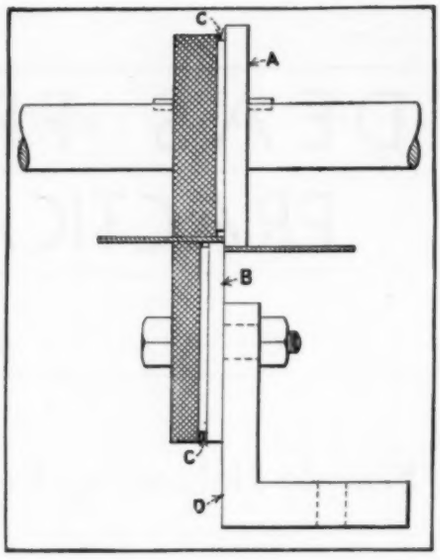
by the dog screw, a split bushing of brass is used. The work is held against the live center by a steel clamp, in one end of which is milled a semicircular opening of the same radius as that of the work, and having sharpened toes. Clamping takes place on the front face of the brass bushing. Since the sharpened toes of the clamp impinge across the diameter of the bushing, and the throat of the semicircular opening is pushed against the work, there is no danger of distortion.

A knurled nut in conjunction with a washer, having a spherical face, gives ample clamping pressure. A slot in the clamp insures quick release of the work when the clamping nut is loosened a turn or two. It is, of course, necessary to have clamps and bushings for each diameter of work. We keep one lathe for this class of work and it is a simple matter to change the clamps and the bushings for the different diameters.

Improvised Rotary Shears

CHARLES KUGLER

The small shop that has no machine for cutting sheet metal can make the device shown in the sketch. It is cheap and efficient and can be used on either the lathe or the milling machine, the milling machine being preferred. It consists of two circular cutters *A* and *B*, one of which is keyed to a mandrel if used in the lathe or to an arbor if used in the milling machine. The other cutter is mounted and runs on a stud held in an angle plate. The cutters are knurled to increase the friction necessary to pull the metal between them.



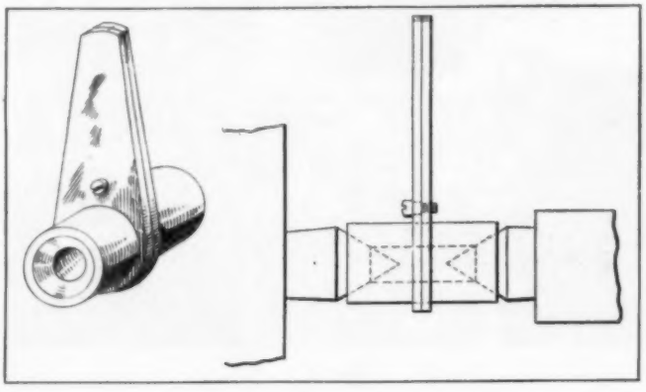
Both cutters are undercut, as at *C*, so that they can be ground without having the wheel come into contact with the knurled part. When dull, the cutters are ground on the periphery, the same as those in a slitting machine. The angle plate *D* can be mounted on either the rest of the lathe or on the table of the milling machine. Both cutters should, of course, be hardened and ground.

Device for Aligning Lathe Centers

MARK L. GLUCKMAN

In the illustration is shown a device to align lathe centers so as to turn work parallel. It consists of two bushings deeply countersunk to fit the lathe centers and two pieces of flat steel. The bushings are shouldered and are forced into holes in the pieces of flat steel. A shoulder screw, placed as near as possible to the bushings for leverage, acts as a pivot. With a mandrel through the bushings to bring them into alignment, a line is scribed on the ends of the pieces of steel.

In operation, the device is placed between the centers with the pieces of flat steel in a vertical position. Any horizontal misalignment of the centers will cause the bushings to move out of line and the pieces of steel to swing upon the pivot screw, bringing the halves of the scribed line on each piece of steel out of register. To align the centers, it is necessary only to adjust the tailstock center until the halves of the scribed line coincide.



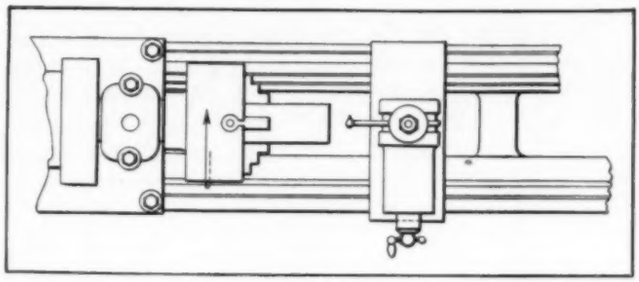
I do not know whether or not this device is in use by any one else, but so far as I know it is original with me, and anyone is free to make and use it. By its use, the centers can be quickly aligned without crude scale measurement or tedious test-bar methods.

Cutting Left-Hand Internal Threads

DANIEL I. KRAUSS

I have noted with interest the methods employed by some machinists in cutting internal left-hand threads in the lathe. I have reference, primarily, to cutting the threads in deep holes of comparatively small diameter and where the cut is generally started at the rear end of the holes.

There are many drawbacks in cutting left-hand



internal threads by running the lathe in the usual direction and starting the cut from the rear of the hole, the lead screw being geared to feed the carriage from left to right. In starting the cut, there is no way in which the tool can be seen. If it so happens in any of the succeeding cuts that the half-nut is not in proper engagement with the lead screw, the job will be ruined before the error becomes apparent.

The better method is to run the lathe backward, gear the lead screw to feed the carriage from right to left, and use a tool that will cut on the far side of the hole. The sketch shows the scheme.

A Special Recessing Tool

W. L. WATERHOUSE
Smethwick, Staffordshire, England

The recessing tool shown in the illustration was designed for machining the annular groove *A*, Fig. 1, in the top and bottom halves of a gear box for a commercial vehicle. The groove was for the purpose of locating the sleeve of a ball race, and it was important that the position in relation to the face *B* should be accurate.

Longitudinal adjustment of the bar is provided for by the nut *C*, which stops against the face of the jig bushing *D* and is locked by a locknut. The recessing cutter *E* has a slot at an angle of 10 deg. in the under side, which engages with a raised key on the part *H*, also shown in Fig. 2. In operation, the bar is placed in position in the jig with the taper shank in the machine spindle and with the adjustment nut *C* against the jig bushing. Forward movement of the machine spindle feeds the recessing cutter outward until the groove has been cut to the correct depth.

The amount of longitudinal feed to give the depth required is obtained by first setting the cutter in contact with the bore and noting the reading on the graduated sleeve of the boring machine. The additional forward movement required is equal to the depth of the groove multiplied by the cotangent of 10 deg. Stop *J* is then set by means of the screw *K* and is locked by a safety setscrew fitting the keyway *L*, thus preventing the stop from turning.

When the spindle and the tool are withdrawn, the compression spring *M* returns the part *H* to its outward position, thus withdrawing the cutter from the work. The sleeve *N* is driven by the key *O*, Fig. 4. The retaining pin *P*, which is a drive fit in the sleeve and passes through a clearance slot in member *H*, is for the purpose of limiting the outer travel of that member. To remove the cutter, the stop *J* is screwed back and member *H* is fed in until the end of the elongated slot contacts with the retaining pin *P*. The cutter can then be removed, the raised key being cut away at *S* for that purpose.

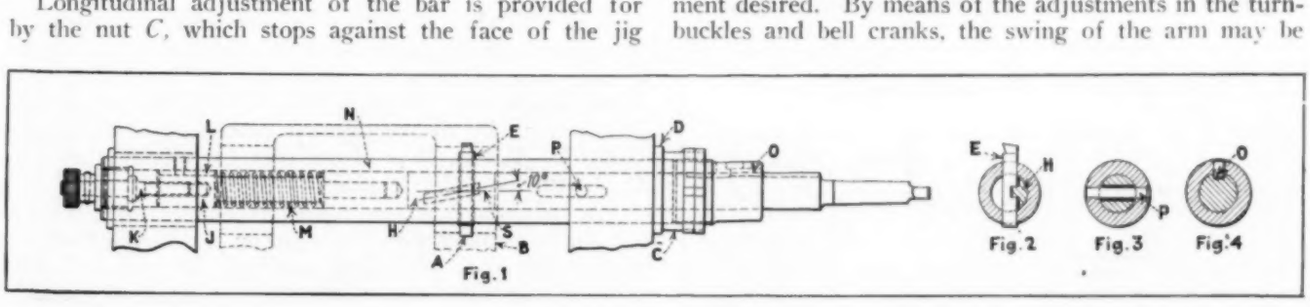
A Swing-Arm Press Guard

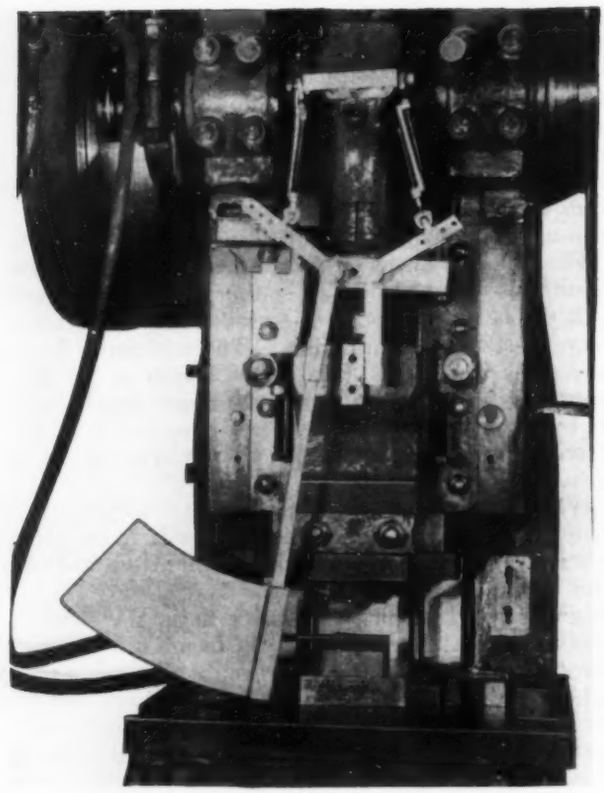
WILLIAM B. KIRTLAND
General Superintendent, Ternstedt Manufacturing Company

A press guard to be effective must be simple in design and must not interfere with the operator's normal motions, nor obstruct his vision of the die. Otherwise, there is an inclination on his part to lock the device or otherwise render it unoperative, particularly if he is on piecework.

Where there are turning operations that involve flying metal and possible injury to the operator, or where white lead is used in drawing operations at high speed with the danger of splash the shield type of guard may be used to advantage. The design illustrated was recently installed at the plant of the Ternstedt Manufacturing Company.

A bracket is mounted on the connecting rod just below the bearing cap. To this are fastened two turnbuckles the lower ends of which are shackled to bell cranks. The upper arm of each bell crank contains a series of holes, any one of which may be used, according to the adjustment desired. By means of the adjustments in the turnbuckles and bell cranks, the swing of the arm may be





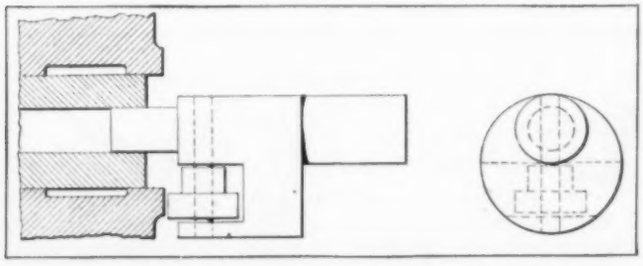
varied from 19 to 32 in. To the lower arm, a wooden sweep, $\frac{3}{8}$x$\frac{3}{4}$ in. is fastened by a setscrew. The shield is attached to this as illustrated.

The photograph shows only one sweep in place, but the other bell crank may be used also if desired. Advantage is taken of the horizontal movement of the connecting rod to give the guard an appreciable movement before the slide has descended more than a fraction of an inch. Before reaching the shielding position, the arm swings the operator's hands out of the die area. To prevent the operator from working from the side of the press, thus circumventing the guard, barriers are placed on either side. This makes it impossible for the operator to position a piece in the die except from the front of the press.

A Putting-On Tool

ROBERT S. ALEXANDER

In machining a number of cast-iron balance wheels, the holes were mistakenly bored 0.002 in. oversize. The holes were to have hardened and ground bushings pressed into them, and the bushings had already been ground to size. As neither time nor money could be spent in making new bushings or replacing the castings, the tool illustrated was devised to bring the holes back to size.

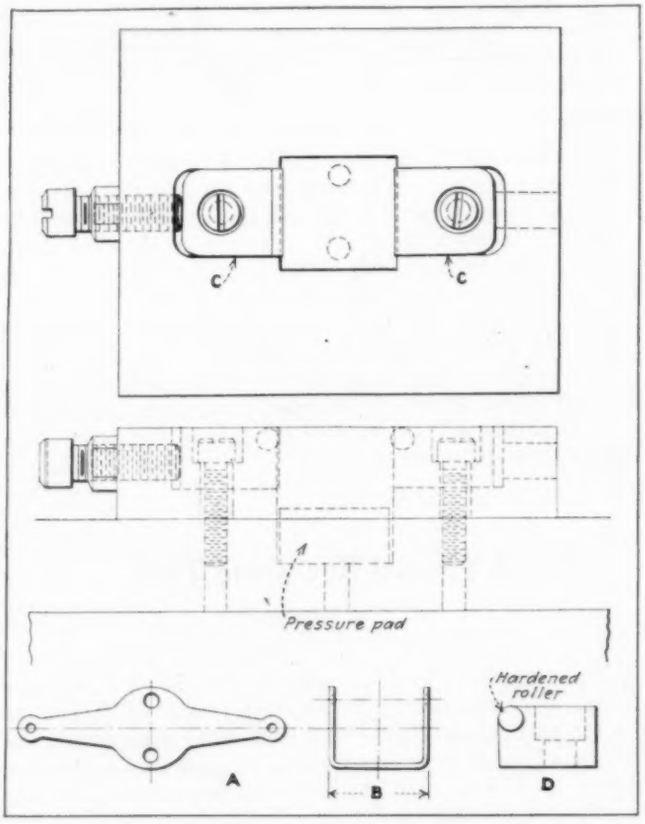


The body of the tool is turned eccentric to the pilot and the shank and carries a hardened roller. The hardened bushing, which acts as a bearing for the pilot, slips into the hole in the work with sufficient clearance to prevent binding when the metal is compressed. With the shank of the tool held in a heavy drill press, a moderate amount of pressure on the rotating roller was sufficient to compress the metal and bring the hole back to the required size, the bearing surface being sufficiently long for the bushings to be assembled with the proper force.

Adjustable, Roller-Type Forming Die

WALTER W. YAEGER

The forming die illustrated has certain features that will probably be of advantage to someone. In forming blanks of the type shown at *A*, it sometimes becomes difficult to maintain reasonable accuracy of the dimension *B* with the ordinary solid dies, caused sometimes by variation in the thickness of the metal, and sometimes by the wear of the dies. With the die illustrated, different thicknesses of stock can be used, and wear can be taken up by the adjustment of the roller forming-blocks *C*. A side view of one of these blocks is shown at *D* with the roller in place.



The advantage of the rollers is readily apparent to anyone acquainted with the wear on the rounded edges of forming dies after long service. In place of the rounded edges are the rollers which, instead of scoring

the stock, turn as the metal passes over them. The success of the die depends upon the care with which the blocks *C* are made. The holes in which the rollers fit must be lapped, and the rollers must be ground and lapped.

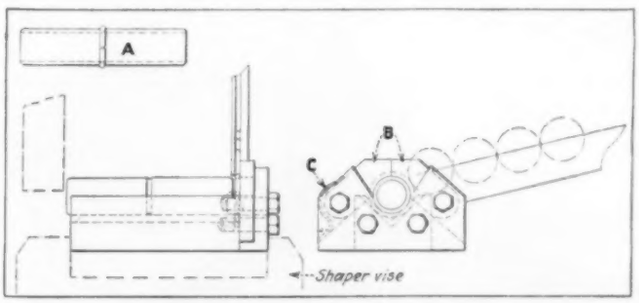
At first, some difficulty may be experienced in making the roller blocks. However, here are a few hints: Use a good oil-hardening steel and leave at least 0.032 in. around the holes for the rollers, so that the thinnest parts will not crack off in hardening. This is also necessary so that the holes can be lapped. All the sides and edges of the blocks must be ground square and parallel with the holes. When the top and inner edges are ground tangent to the holes, the corners will readily drop off. It is advisable to grind about 0.003 in. below the tangent line on the inner edges to avoid the possibility of the work being scored by the sharp edges below the center of the rollers.

With a die of this type, when the rollers wear they can easily be replaced, and if they are working as they should there be no scoring of either them or the blanks, thus assuring smooth surfaces in the finished parts. The punch can be made with removable wear strips on the sides, so that in conjunction with the adjustability of the roller blocks, any of the dimensions of the formed blanks can be maintained by using thicker or thinner strips.

Assembling in the Shaper

STANLEY PIVOWSKI
Toolroom Foreman, Anchor Post Fence Company

In the manufacture of our product we used a special pipe coupling, one of which is shown at *A* in the illustration. The coupling is made of 1-in. pipe and is chamfered at both ends and grooved in the center, the



work being done in a screw machine. An open ring, made of No. 6 spring-tempered wire, is assembled in the groove. Since no press having a sufficient stroke for the assembling was available, we resorted to the shaper and made the fixture illustrated, which was held in the shaper vise.

The body of the fixture is a V-block to which the wings *B* are pivoted, being held in the closed position by flat springs, as at *C*. Attached to the fixture at an angle is a magazine for holding the springs, allowing them to drop by gravity, one at a time, against a stop that brings them fair with the opening in the V-block.

In operation, with the shaper ram set to a stroke of about 12 in., and a piece of steel held in the toolpost, and the magazine filled with rings, the operator places a coupling in the V-block. With the shaper running continuously at a slow speed, the piece of steel in the toolpost forces the coupling through a ring a predetermined distance, allowing the ring to snap into the groove. The assembly is removed by raising it, thereby opening the wings, which are immediately closed by the springs. Another coupling is placed in the V-block, and the operation is repeated until the supply of rings in the magazine is exhausted.

SEEN AND HEARD

JOHN R. GODFREY

Still Another Metal

To engineers of inquiring mind A. W. Frehse of the Chevrolet organization offers the life and other history of a remarkable new metal. Readers are urgently requested *not* to write in for further information.

"This metal was discovered by means of the spectroscope on the asteriod Xerxes by a young astro-physicist. The absorption lines showed remarkable characteristics inasmuch as the images of the slit become parabolic curves. The astro-physicist maintained great secrecy with his discovery, and one day recently had the great good fortune to discover the metal in his laboratory from samples he found in the State of Conn. By further prospecting during his summer vacations, he found the metal to exist in enormous quantities in the same state, and after reducing it from the ore, the process of which is extremely simple but closely guarded, he proceeded to examine its physical properties. These he found to be extraordinary, in fact, so remarkable that he decided to call the new metal "Automobileium," because it at least completely covered the automobile engineers' specifications of an ideal material with which to design and manufacture all automotive apparatus. The material is now available in great quantities at a cost somewhat lower than that of iron.

"The physical properties of the metal are:

Weight—about the same as magnesium;
Color—pale blue;
Melting point—this can be varied to suit conditions;
Coefficient of expansion—slightly less than Invar;
Modulus of elasticity—1,000,000,000;
Ductility—exceeds that of platinum;
Electrical conductivity—slightly greater than silver;
Hardness—a little harder than Stellite;
Machineability—about the same as butter at 72 deg. F.

"The metal requires no lubrication because it refuses to rub elbows with the commoner metals. In fact, it exceeds by far in all characteristics the qualities of ferro-*manurium* used so extensively in practice today."

Only a Change in Templets

One machine tool builder, who has gone from castings to "weldings" for his product, brings to mind another advantage of welded construction. An important change had to be made in his frame. Under old methods he would have been forced to the expense of a revamped pattern. As it was he had only to modify the templets which guide his cutting torch.

SHOP EQUIPMENT NEWS

Landis Automatic Forming and Threading Machine with Stud Attachment

An attachment has been developed by the Landis Machine Co., Inc., Waynesboro, Pa., for its automatic forming and threading machine, adapting it for the manufacture of studs. Working on studs, this $\frac{3}{4}$-in. machine has the production rating increased 200 to 500 per cent, because the loading, unloading, pointing and threading operations are performed simultaneously at three separate stations. The attachment is a self-contained unit which can be applied to machines in service. It is adjustable and will accommodate studs from $\frac{1}{4}$ to $\frac{3}{4}$ in. in diam., from $1\frac{1}{2}$ to 6 in. in length, and with a $2\frac{1}{2}$ in. maximum thread length. The unthreaded section of the stud cannot be less than 75 per cent of the diameter. The attachment can be applied and set up in 30 min. It will take sheared blanks.

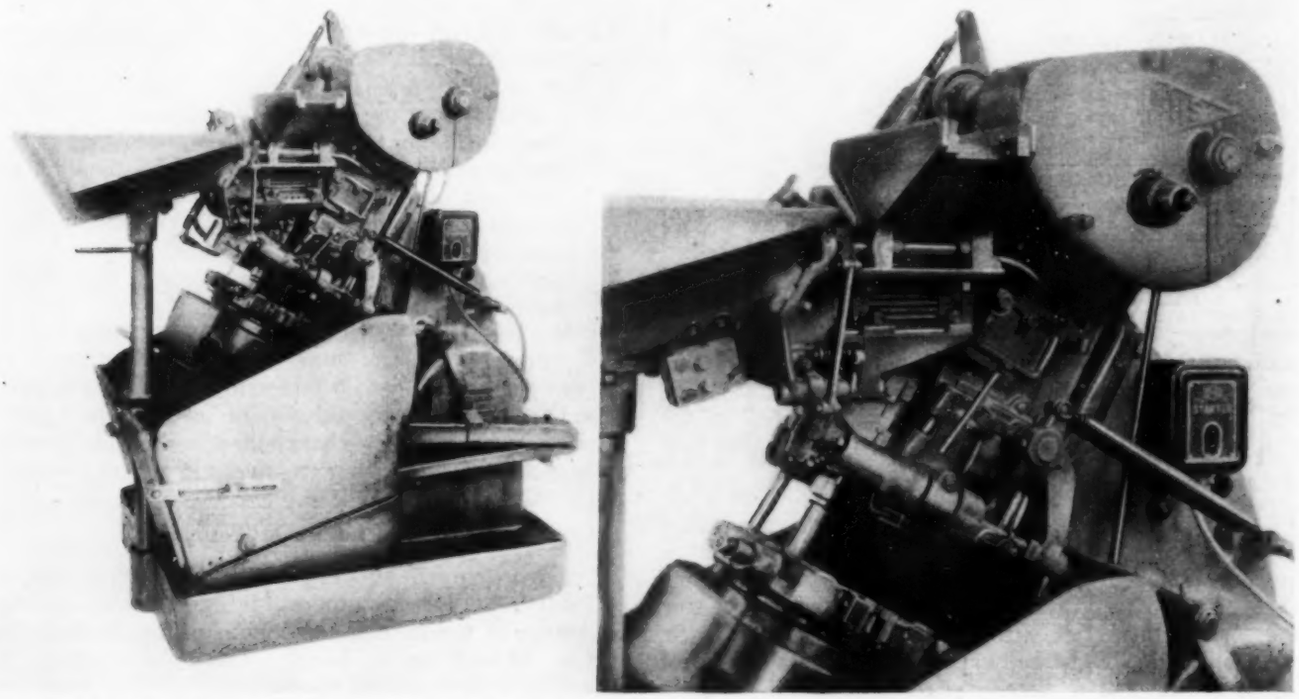
The attachment consists of a hopper and magazine, an agitator at the base of the hopper insuring an uninterrupted flow of blanks to the magazine. Blanks are fed one at a time to a slot through which they drop into an auxiliary magazine, which positions the blanks for transfer to the loading station of the turret. For the second operation, the semi-finished studs are stacked in the hopper with their blank ends at the front. The pointing head takes care of any variation in the length of the blanks.

Porter-Cable Type E-7 Disk Sander-Grinder

A portable disk sander-grinder with a built-in vacuum system for picking up the dust has been developed by the Porter-Cable-Hutchinson Corp., Syracuse, N. Y. This Type E-7 disk sander-grinder has a 7-in. abrasive

disk which travels at 3,200 r.p.m. A rubber pad gives a flexible backing to the disk.

The sander is operated by grasping the two handles and tilting it forward about 5 deg. A double-pole toggle switch is mounted on one handle, making it accessible to the right thumb. Power is furnished by a 1-

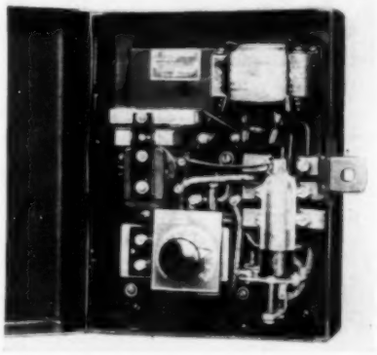


Left—The stud attachment can be attached to Landis Automatic Forming and Threading Machines in service. Right—Close-up of stud attachment which will handle sheared blanks from $\frac{1}{4}$ to $\frac{3}{4}$ in. in diameter by $1\frac{1}{2}$ to 6 in. in length

hp. motor protected from dust. The disk sander-grinder can be used in preparing automobile bodies for painting, grinding down welds, smoothing castings or finishing metal surfaces. When used in conjunction with the Emmons Balancer, it can be suspended at any height to remove the weight from the operator's arms and permit ready application of the disk to the work. Height over-all of the tool is 12 in., and weight is 21 lb.

Cutler-Hammer Tube Timer Control for Resistance Welders

Cutler-Hammer, Inc., 296 N. 12th St., Milwaukee, Wis., has announced a timing device for spot, projection and other forms of resistance welders. Accurate timing control of the weld-

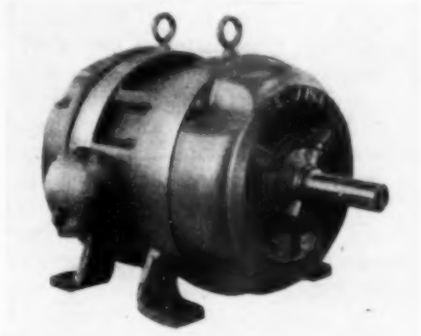


ing operation is made possible by the use of an electronic tube. The range of adjustment ranges from a fraction of a second to 16 sec. The device enables unskilled operators to produce successful welds and to eliminate rejects and throw-outs. Timing is adjusted by a knob inside the inclosing case.. The mounting space required by the control is small, and the device is operated on 110 to 550 volts a.c., 25 to 60 cycles. The device is known as Bulletin 13101, and vibration will not affect its accuracy.

Reliance Punch Press Motors

The Reliance Electric & Engineering Co., 1088 Ivanhoe Road, Cleveland, Ohio, has developed a line of induction motors especially adapted for punch presses and machinery with similar operating characteristics. These motors range in size from $\frac{3}{4}$ to 200 hp. The installation and operating costs are lower and the power factor is improved.

In the design of these motors the flywheel was especially considered. During the unproductive part of the



operating cycle the motors deliver power to the flywheel, and when work is being done they slip and permit the flywheel to carry the brunt of the load. A starting torque of approximately 225 per cent is developed and the slip is from 8 to 12 per cent. Normal starting current is required. The frame is fabricated from bar steel, electrically welded. Either ball or sleeve bearings are furnished. The motor may be obtained in either open, fully inclosed or fully inclosed fan-cooled types.

Gray Turret Head Metal Cutter
Correction

The Gray Machine Co., Box 596, Philadelphia, Pa., with plant at 7th & Wood Sts., is the manufacturer of the "Gray" turret head metal cutter or nibbling machine announced on page 281, last week's issue. Through misinformation the machine was attributed to the W. J. Savage Co., Knoxville, Tenn., which formerly built an earlier design under license. The license agreement has been terminated, and the Gray Machine Co. is now offering the model redescribed in full below.

The turret head of this machine allows the operator to cut shapes in sheets or plates of any design without the necessity of turning the stock through the gap or throat. This feature enables the use of a much smaller throat machine, reduces the necessary floor space, and facilitates cutting the shapes when the sheets are too large to swing through the throat. Where small pieces can be turned, the turret may be locked in eight different positions to accommodate best the handling of stock. The shapes cut are not distorted, but are left flat with clean cut edges that do not require filing.

A second feature is the double-micrometer adjustable strippers. When duplicating parts by master

Gray Turret Head Metal Cutter with circle-cutting attachment

templet, one of the strippers may be adjusted to rest or strip on top of the templet, while the other is resting on the stock, which is on a lower plane than the templet. This prevents the stock and templet from being picked up more on one side than the other, makes stripping even and level, and prevents chatter.

The machine is shown here with a circle-cutting attachment. Rest arms for supporting the stock while cutting are shown at each side of the machine. These arms can swing to any position to support the stock and to such a position as not to interfere with the operator's movements. The ram guide bushing has a micrometer tightening adjustment that insures accurate alignment of the cutters with the die.

The machine is built in several sizes, capable of cutting stock of the thinnest gages and up to 1-in. plate by the nibbling process. In addition, the Gray turret head metal cutter can be quickly converted into a shearing machine for light gages and up to $\frac{1}{8}$-in. stock. A special gag mechanism is furnished to disengage the cutting tool, lifting it high enough over the master templet and stock so that the tool can be entered when making inside cuts.

Ex-Cell-O Railroad Bushings and Pins

Hardened and ground brake bushings and brake pins have been developed by the Ex-Cell-O Aircraft & Tool Corp., 1200 Oakman Blvd., Detroit, Mich., for the maintenance of clasp brakes on passenger cars and locomotive tenders. These pins and bushings have a case of approximately 1/32 in. and are ground to definite limits. These products can be quickly and economically applied without re-sizing. Brake bushings are made in 27 sizes and brake pins in 15 sizes. Hardness of both the brake pins and brake bushings is 615 Brinell or 60 Rockwell.

Crawford Preheating Oven for Welding Castings

Large castings, especially those of aluminum, present difficulties in making welding repairs because of warping and cracking when they are not uniformly heated. Therefore, the Crawford Oven Co., New Haven, Conn., has designed a preheating oven of the type shown. This preheater is said to have the following advantages: uniform heating and cooling; elimination of drafts through the preheater; ease with which the piece may be handled, and the accessibility for welding operations by means of sliding doors.

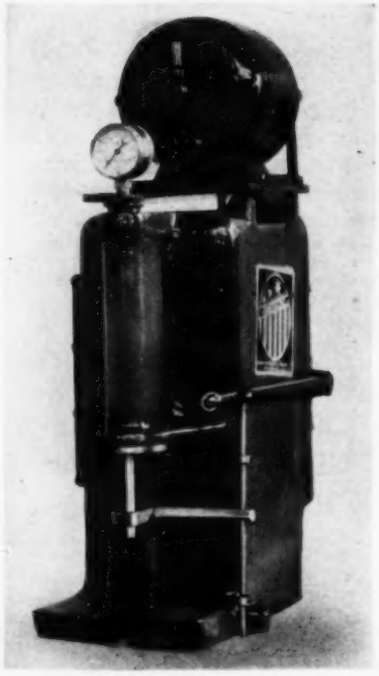
The equipment is built in two sections, the burner section below and the heating chamber above. The upper section is built with sliding doors at the front, back, top and at each side. Through these sliding doors any part of the work can be reached by the welder, using a minimum opening, thus eliminating cold drafts on the casting. While the entire top is composed of sliding doors, it is hinged to load and unload the pieces. The casting is held above the heating chamber on cast-iron grate bars over which is distributed refractory materials. The casting itself rests on a metal plate to permit ease in moving it about during welding.

During the heating period all doors remain closed, but when the proper temperature is reached the operator welds through the small sliding door located nearest to the break. A number of fractures can easily be welded by using the nearest doors. After all welds have been made, the heat is gradually decreased by turning down the gas burners a few at a time or by thermostatic control. A large casting left in the preheater overnight will cool to room temperature.

The preheater has a heater section 5 ft. long, 3 ft. wide and 2 ft. high. It can be made, however, in any size to suit the type of work.

"American" Type V-000 Hydraulic Bench Press

A hydraulic bench press of $\frac{1}{10}$-ton capacity has been developed by the American Broach & Machine Co., Ann Arbor, Mich. The press ram operates at 90 ft. per min., and the return speed is 120 ft. per min. The knock-off shaft is provided with stop dogs that can be adjusted for any desired stroke. Control of the press is effected by a hand lever, and upon release of this lever the ram returns automatically to its top or starting position. The work table is 7 in. wide, and the depth of throat is 2 in. Maximum space between the top of the table and the end of the ram is $5\frac{1}{4}$ in. The machine is equipped with an "American" built-in pumping unit and four-way control valve, these two members being built into a flanged panel. An adjustable relief valve permits varying the pressure to suit. The machine is arranged for motor drive only, the drive being by Texrope. A direct-reading gage shows the pressure on the ram in lb. per sq.in.



Specifications: Stroke, $5\frac{1}{4}$ in.; diameter of ram, $\frac{1}{2}$ in.; width of slot in table, $1\frac{1}{8}$ in.; height of machine from base to top of cylinder, $14\frac{7}{8}$ in.; weight, 140 lb., and motor recommended, $\frac{1}{2}$ hp., 1,800 r.p.m.

"Aluminweld" Electrode for Welding Aluminum

The Lincoln Electric Co., Cleveland, Ohio, has announced "Aluminweld" electrode for welding aluminum. This electrode is a 5 per cent silicon-aluminum alloy and can be used for welding either sheet or cast aluminum by the metallic or carbon arc. The coating provided on the electrode prevents excessive oxidation and will dissolve any aluminum oxide that might be formed. The coating assists in giving a smooth operating arc. The resulting weld is without porosity and possesses high tensile strength. It is also claimed that the weld can be polished satisfactorily with practically no discoloration.

In using this electrode, a short arc of approximately 20 volts should be used with the coating practically in

contact with the work. The current will vary with the thickness of sheet or material to be welded but the following data gives an idea of the proper values:

Size Electrode	Average Current
3/32 in.	40 amp.
1/8 in.	70 amp.
3/16 in.	125 amp.

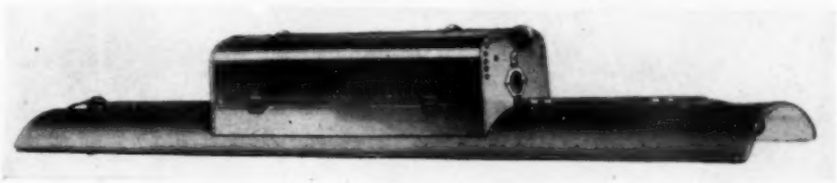
The $\frac{3}{32}$-in. electrode is used for sheet up to 14 gage, $\frac{1}{8}$ in. for 14 gage to $\frac{1}{8}$ in., and $\frac{3}{16}$ in. for sheet over $\frac{1}{8}$ in. thickness. Sheets of over $\frac{3}{16}$ in. thickness should have the edges beveled if welded from one side only. Aluminweld is produced in four sizes, $\frac{3}{32}$, $\frac{1}{8}$, $\frac{5}{32}$ and $\frac{3}{16}$ in. in 14 in. lengths.

Cooper-Hewitt Improved Industrial Mercury-Vapor Lamp

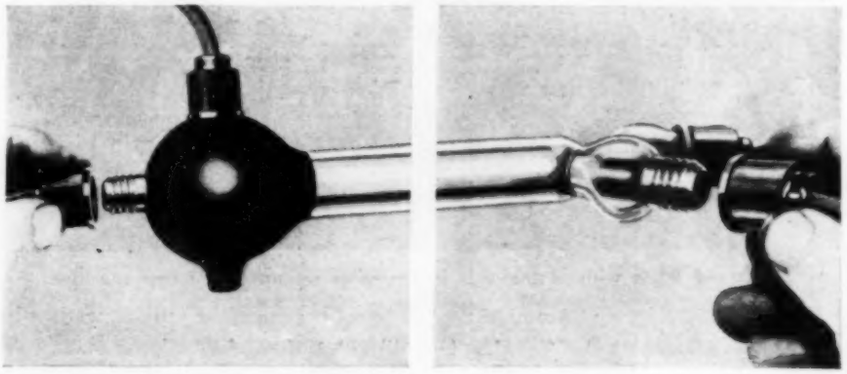
Many improvements of major and minor importance have been made in the Cooper-Hewitt mercury-vapor lamp manufactured by the General Electric Vapor Lamp Co., Hoboken, N. J. A summary of the changes includes: Improvements in tube design and performance; simplified reflector equipment; simpler and sturdier auxiliary equipment, and electrical features embodying the latest requirements of the Underwriters' Laboratories. Sharp corners have been eliminated and the general mechanical appearance improved.

A straight-line appearance has been developed for the vapor tube. Positive terminals are now in the plane of the tube and are materially reduced in length. Negative terminals have been relocated at the top of the bulb and reduced in length. Two styles of tube are now available, one for horizontal operation and the other for vertical operation. All tube terminals are now of the intermediate screw-base, screw-shell type, and by means of insulating covers they are easily attached by hand. The location of the negative terminal serves as a positioning point and prevents rotation of the tube in service to eliminate burnouts.

Externally the auxiliary is slightly longer than previous models and has been improved in appearance. Within the auxiliary, greater spacings are provided which permit easier access to the resistance units, transformer taps and attachment plug. A copper-oxide rectifier has been substituted for the starting resistance coil, and supplies direct current to the shifter action to make the starting twice as fast as was possible in older models. The ballast resistance coils vary their temperature and absorb more or less voltage as required to maintain a uniform tube current. This results in a much lower fluctuation in light output with varying line voltage. The mercury-vapor lamp is available in standard black finish and also in battleship gray.



Better appearance and reduced fluctuation of light output are features of this lamp



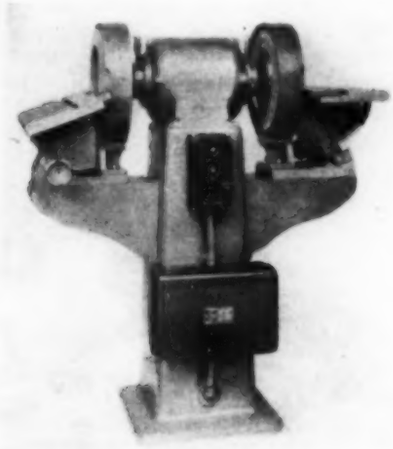
Tube terminals are now of the intermediate screw-base, screw-shell type and by means of insulating covers are easily attached by hand

"Stackbin" Machine Tender

The Stackbin Corp., Providence, R. I., has developed an inclosed type, sheet-steel machine tender for the use of machine tool operators. All tools and necessary dogs, chucks and other parts can be stored at arms length from the machine. This saves time and makes work easier for the operator. It also provides him with a personal cabinet for which he can be held responsible. The tender is equipped with a shelf, bench top and two doors provided with a padlock hasp. The size is 18 in. deep by 30 in. wide by 32 in. high. Bin finish is soft velvet green. The tender can be supplied with or without casters.

Ransom No. 107 T.C. Tool Grinder

The No. 107 tool grinder developed by the Ransom Grinding Machine Co., Oshkosh, Wis., has been designed especially for grinding ordinary lathe and planer tools tipped with tungsten carbide. The grinding is done on cup wheels, and large



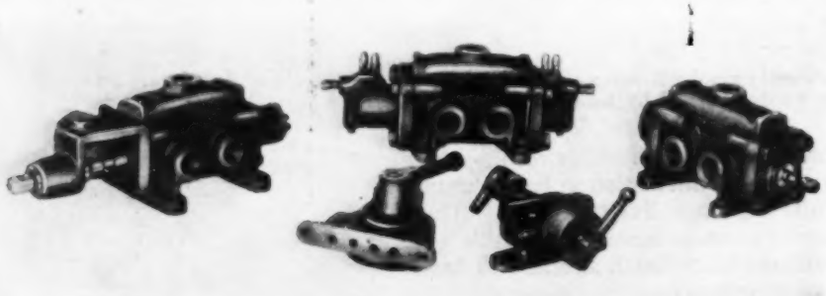
tables have been provided so that ample support is had for the shank of the tool in whatever position it is held. The tables are tiltable to 20 deg. by means of a gear and pinion. Both roughing and finishing wheels are provided. A steel guard is provided for each wheel.

Each table with its guard is adjustable toward the wheel to compensate for wear. The table holder slides on a grooved bracket to which it can be clamped in any position. A reversible-type motor is employed so that the operator can grind clearance on the tool in any direction, and so that both right- and left-hand tools can be ground. Time required to reverse the arbor from full speed in one direction to full speed in the opposite direction is 4 sec. Lubrication of the bearings is accomplished with filtered oil.

Vickers Balanced 4-Way Valves

Hydraulic balance in the 4-way control valves announced by Vickers, Inc., 7742 Dubois St., Detroit, Mich., is said to prevent binding of the valves due to pressure and to give sensitive operation. These compact valves are easily applied to machine tools or other hydraulically operated equipment, and are used for operating pressures up to 2,000 lb. per sq.in.

Of the three types of 4-way valves shown, the one at the left is a latch-controlled valve which makes one complete cycle and then stops. This valve is adapted to press operations and hydraulically operated furnaces. The operator manually starts the machine in one direction. At the end of the stroke a stop trips the latch and allows an internal spring to shift the valve to the reverse position. When the end of return is reached, the machine is stopped by the valve. A pilot-operated 4-way valve with manual and mechanical pilot valves constitutes the center group. It provides remote control without the use of levers or linkages. It has simple external adjustments for controlling the reversing speed to eliminate shock on rapidly moving tables. The manually operated 4-way valves are at the right. Bulletin 31-4 gives complete details of these valves.

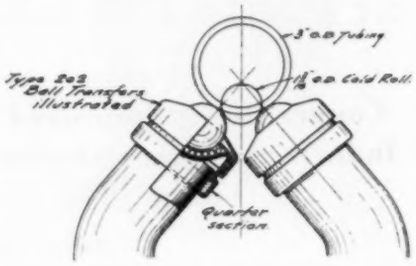


• EQUIPMENT ADAPTATIONS •

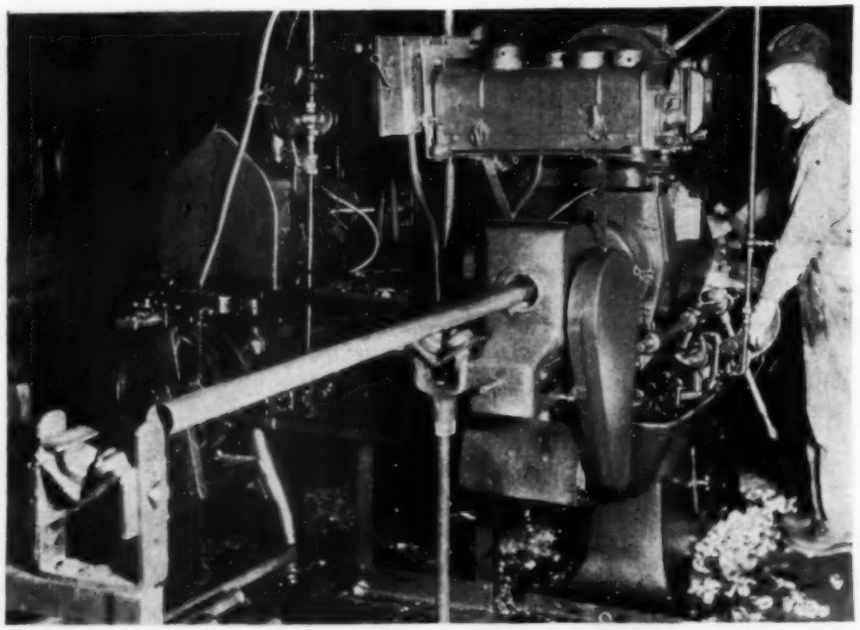
Recently Developed by the Makers

Mathews Ball Transfer Used On Cutoff Stands

The Mathews Conveyor Co., Ellwood City, Pa., has adapted its ball transfer (*A M*—Vol. 74, p. 921) to bar stands for cutoff operations. The stands can be designed in several different arrangements. For example, a pipe leg set in a heavy base with the ball transfers mounted on top and set at an angle to suit the size of stock is one method. By another method structural angle members are welded together and arranged for mounting the ball transfers at suitable angles. Another method is to use separate vertical pipe standards, bent at the top so as to mount the ball transfers at the suitable angle. It is also possible to weld two ball transfers on a piece of structural steel angle and fit a vertical upright underneath the bottom side of the angle. This feature sets the ball transfers at a 90-deg. angle. Two types of ball transfers are available for this use: Type 202 for medium-size rounds or tubing ranging from 1 to 3 in. O.D. and Type 500 for heavier stock ranging from 3 to 8 in. O.D.



Method of set-up for two Mathews Type 202 Ball Transfers for cutoff operations on tubing to 3 in. O.D.



Bar stand fitted with Mathews Ball Transfers set up at a cutoff machine

In the quarter-sectional view showing the inside of the ball transfer, a bed of 105 $\frac{3}{16}$-in. balls is used to

carry the large or load-carrying ball. The bed of balls is free to rotate without pushing or crushing action. The raceway is so designed that the balls find other positions under the load-carrying ball while it is rotated.

Clutch Plates Straddle Milled and Drilled on Special Millholland Machines

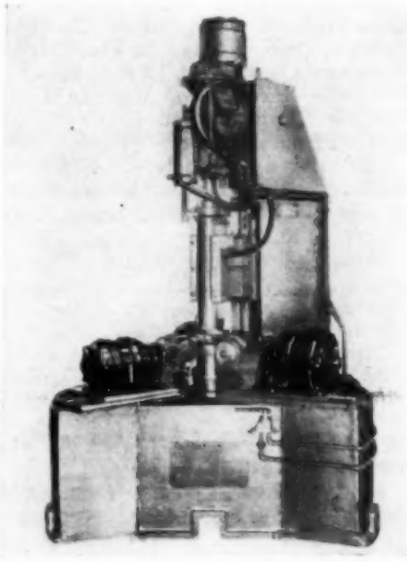
Two special machines have been developed by the Millholland Corp., 1145 E. 22nd St., Indianapolis, Ind., for operations on automobile clutch plates. The first machine straddle mills the three ears simultaneously without indexing the piece. The three motor-driven milling units are placed 120 deg. apart on a circular bed, and these are adjustable to accommodate larger pieces. A 10-in. air cylinder maintains a constant pressure on the lower plunger, and provides the pressure by which the cam on the No. 5 Millholland automatic unit clamps the piece and feeds it down past the three sets of straddle milling cutters.

The milling machine operates as follows: The operator places a piece in approximate position over nest pins on the locating fixture on top of the lower cylinder. The air control valve is thrown to engage the feed on the cam-driven unit. The upper plunger comes down at rapid traverse until the feed is cut down to the correct cutter feed. At conclusion of the feeding stroke, the cam on the feeding unit permits the withdrawal the upper plunger, and the lower plunger maintains the pressure. At the top limit of the lower plunger travel, the cam on the feeding unit permits the upper plunger to move 5 in. farther to open the fixture.

The close-up view shows at the right of the finished piece one of the three chip funnels sunk into the bed. These chip funnels are located directly under the cutters, and are connected to large pipes leading out through the bed to openings in the back, allowing chips to flow out by gravity to the chip boxes at the rear.

Provision for cutter adjustment is provided for by means of a hollow spindle in which the cutter arbor is carried. A single spacing collar back of the shoulder on the arbor provides for sidewise adjustment of the group of three cutters. Adjustment of the speed of the cutters can be obtained by changing the pick-off spur gears to the milling spindle. A change of the length of stroke or rate of feed can be accomplished by a change of the cam or the pick-off feed gears.

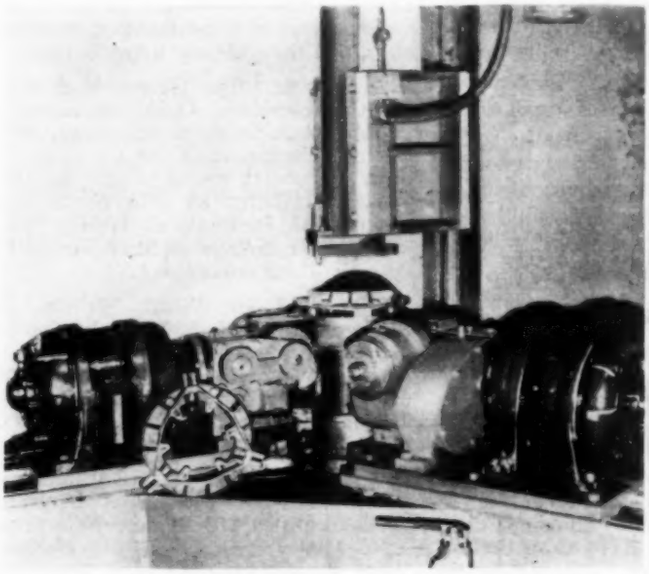
The drilling machine employs three No. 3 Millholland automatic drilling units, each equipped with a combination drill and reamer. One air valve engages the feed on all three drilling units simultaneously after the piece has been clamped by the air plunger. Accuracy of spacing is obtained by this method so that the piece does not have to be removed from the machine to be reamed. Stepped holes can be drilled and reamed accurately. In order to move the dovetail bases into position for larger pieces, the bases are mounted on large flat keys. Bolt holes are drilled in the base for approximate new locations.

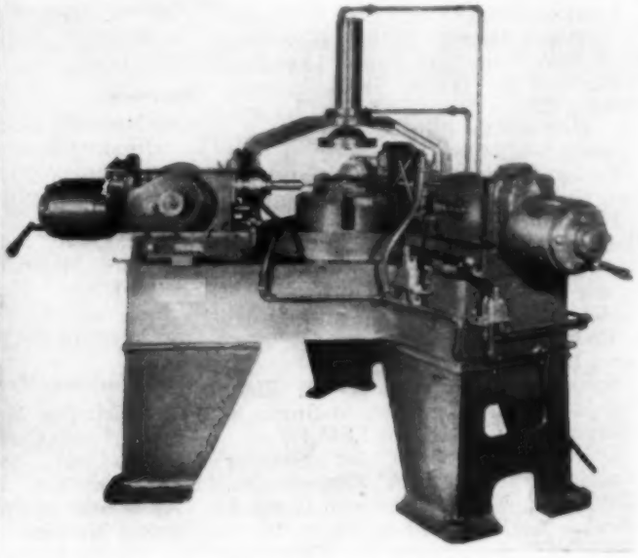


Special machine for straddle milling three ears on clutch plates

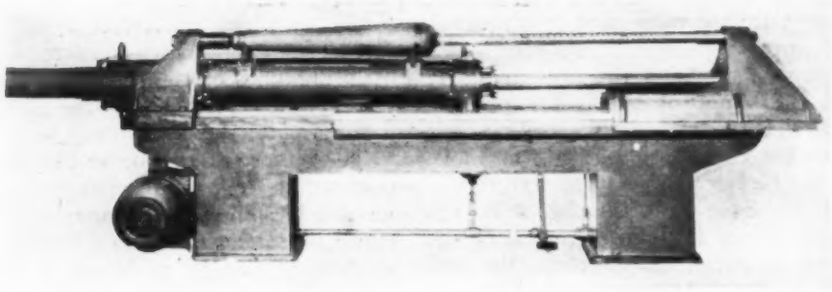
American Muffler Assembly Press

A hydraulic press for the assembly of mufflers has been developed by the American Broach & Machine Co., Ann Arbor Mich. The illustration shows a muffler mounted on two receiving jacks and also shows the inner core of the muffler placed over the nose piece on the slide and ready





Left—Close-up of the straddle milling heads, showing the fixture in the top position and the cam feeding unit. Right—A combination drill and reamer in each head assures accurately spaced holes



American Hydraulic Press for assembling the core to the body of a muffler

to be pushed into the body of the muffler. The press is so arranged that when the core is pushed into the muffler, the ends are upset at the completion of the assembly, thus flaring the ends into the muffler body itself.

In operating the press, the muffler core is slipped on to the plug mounted in the slide, and the body of the muffler is dropped onto the centering jacks. Pressure is applied to the pedal which causes the slide to advance rapidly. When the assembly is completed an auxiliary cylinder comes into action to give extra pressure at a very slow speed for flaring the ends. The cycle requires about 12 sec.

• PATENTS •

FEBRUARY 23, 1932

Metal-Working Machinery

Riveting Machine. Adin U. Kerns, Altoona, Pa. Patent 1,846,116.

Grinding Machine. Maxwell I. Mathewson, Providence, R. I., assignor to Brown & Sharpe Mfg. Co. Patent 1,846,132.

Vertical Deep Hole Drill. Henry R. Krueger, Detroit, Mich., assignor to Pratt & Whitney Co. Patent 1,846,211.

Machine for Testing Hobs, Worms, and the Like. Carl G. Olson, Chicago, Ill., assignor to Illinois Tool Works. Patent 1,846,270.

Surface Grinding Machine. Karl Jung, Berlin, Germany. Patent 1,846,341.

Hydraulic Feed for Machine Tool Heads. George E. Hallenbeck, Toledo, Ohio, assignor to Baker Brothers, Inc. Patent 1,846,391.

Metal Working Press. Frederich J. Rode and Rudolph W. Glasner, Chicago, Ill. Patent 1,846,439.

Screw Machine. Charles A. Rich, Providence, R. I., assignor to Brown & Sharpe Mfg. Co. Patent 1,846,497.

Duo Stroke Series for Shaping Machines. William F. Zimmermann, Maplewood, N. J., assignor to Gould & Eberhardt. Patent 1,846,780.

Machine for Internally Threading Sleeves. Archibald L. Wallace, Brooklyn, N. Y. Patent 1,846,925.

Coupling Boring and Threading Machine. Fred H. Bogart, Cleveland, Ohio, assignor to The Warner & Swasey Co. Patent 1,846,986.

Tools and Attachments

Tool Controlling Mechanism for Machine Tools. Fred H. Bogart, Cleveland Heights, Ohio, assignor to The Warner & Swasey Co. Patent 1,846,014.

Spindle Bearings for Machine Tools. William Wallace Potter, Pawtucket, R. I. Patent 1,846,142.

Self-Opening Die Head. Edwin O. Williamson, New Haven, Conn., assignor to The Eastern Machine Screw Corp. Patent 1,846,296.

Power Transmission for Shaping Machines. William F. Zimmermann, Maplewood, N. J., assignor to Gould & Eberhardt. Patent 1,846,297.

Thread Cutting Tool. Robert Thomson, Newark, N. J., assignor to Dardelet Threadlock Corp. Patent 1,846,408.

Hob. Ernest C. Head, Rochester, N. Y., assignor to Gleason Works. Patent 1,846,640.

Rod Feeding Collet. George M. Smith, West Haven, Conn., assignor to The Eastern Mach. Screw Corp. Patent 1,846,695.

Workholding Chuck. Clifford I. Packer, Meriden, Conn., assignor to The C. I. Packer Tool & Die Co. Patent 1,846,898.

Cutter. John P. Breuer, Rockford, Ill., assignor to Barber-Colman Co. Patent 1,847,054.

Processes

Method of Grinding Hobs. Carl G. Olson, Chicago, Ill., assignor to Illinois Tool Works. Patent 1,846,272.

Method of Feeding Articles to Grinding Machines. Albert Vuilleumier, Bristol, Conn., assignor to The New Departure Manufacturing Co. Patent 1,846,661.

FEBRUARY 16, 1932

Metal-Working Machinery

Roll Grinding Machine. Carl Morey, Ansonia, and Carl F. Schnuck, New Haven, Conn., assignors to Farrel-Birmingham Co. Patent 1,845,172.

Automatic Multiple Spindle Center Turning Machine. Edward P. Bullard, Jr., Stratford, Conn., assignor to the Bullard Co. Patent 1,845,478.

Machine Tool. Sol Einstein and Lester F. Nenninger, Cincinnati, Ohio, assignors to Cincinnati Grinders Incorporated. Patent 1,845,865.

Tools and Attachments

Control Mechanism for Presses and the Like. John A. Hinger, Cleveland, Ohio. Patent 1,844,935.

Collet Means. Joseph F. Buhr, Ann Arbor, Mich. Patent 1,845,123.

Chuck. Fred H. Bogart, Cleveland Heights, Ohio, assignor to the Warner & Swasey Co. Patent 1,845,226.

Processes

Method of Making Hobs. John Edgar, Rockford, Ill., assignor to Barber-Colman Co. Patent 1,844,947.

Machining Method (for tubular articles). Otto R. Briney, Pontiac, Mich. Patent 1,845,122.

• TRADE PUBLICATIONS •

DIE STEEL. The Ludlum Steel Co., Watervliet, N. Y., has issued a sheet on "Ontario" air hardening die steel, giving physical properties, and information on hardening, tempering, annealing, forging and machining, as well as the application.

MOTORS. The Bodine Electric Co., Oakley Blvd. & Ohio St., Chicago, Ill., has issued Bulletin No. 1013 on electric governor controlled constant-speed universal motors with and without integral gear reducers.

SCREWS. The Parker-Kalon Corp., 200 Varick St., New York, N. Y., has issued a catalog on its products for making fastenings to sheet metal, steel, cast iron, die casting, brass, Bakelite, metal to wood, and other materials. Complete descriptions are given of the various types of self-tapping screws and nails, and the sizes are listed in tables.

STAMPINGS. The Geometric Stamping Co., Cleveland, Ohio, has issued a 28-page book on metal stampings, containing reference data for use of engineers in drawing up specifications. The booklet is illustrated with charts and graphs and incorporates tables. The price of the bulletin is $1.00 except to executives and engineers.

TOOLS. J. H. Williams & Co., 75 Spring St., New York, N. Y., has issued its twenty-first edition of its complete catalog giving 216 pages on its line of drop forgings and drop-forged tools. The line includes wrenches, chain pipe tongs, and industrial tools.

WIRE-ROPE. The Hazard Wire Rope Co., Wilkes-Barre, Pa., has issued a booklet entitled "12 Reasons Why You Save Money with Lay-Set Preformed Wire Rope." Information is also given on wire rope construction and how to order wire rope.

American Machinist
Reference Book Sheet

EXPANSION AND COMPOUND FITS BY REFRIGERANTS

SHRINK fits, in which the outer part is expanded by heating, then slipped over the inner to create a tight fit when cooled, are commonly used; *expansion* fits in which the *inner* part is cooled by refrigerants, then slipped into the outer and allowed to expand, have been used practically not at all until recently. The process has been expensive, and until the advent of suitable liquid-air containers and solid carbon dioxide (Dry-Ice) was difficult to handle. Now, however, the process is simple, and provides an easy method of fitting with speed, cleanliness, lack of effect on heat-treated parts, freedom from scaling or discoloration. Where parts that would normally require heating are large and heavy compared to parts to be inserted, where heating causes cracking and warping, where outer parts have insulation or finish such as rubber or paint that heat would damage, or where furnace equipment is not available, the advantages are apparent.

Solid carbon dioxide becomes a gas at — 110 deg. F., liquid air at — 310 deg. F., giving possible cooling ranges of 180 and 380 deg. F. respectively, from room temperature (70 deg.). Approximate contraction or decrease in linear dimension of various metals, per inch of length or diameter, when cooled in these refrigerants, is given in Table I. The linear dimension—usually diameter—of the part to be contracted is simply multiplied by the factor for the cooling medium used. Thus, a 2½-in. brass bushing will contract 2.5 × 0.0031 = 0.0077 in. when cooled in liquid air from room temp., reducing its diameter to 2.4923 in.

Expansion Fit Allowances

The resulting stress in the parts depends upon the fit allowance. Where the allowance is too great, the elastic limit of both parts may be exceeded and a permanent set occurs. In extreme cases, the ultimate strength of the material is exceeded, causing a rupture. The intensity of the grip and the resistance to slippage of expansion fits increases with the thickness of the parts, of course. The amount of contraction available for expansion fits is ordinarily less than that in shrink fits, therefore smaller allowances are required.

Table I—Linear Change in Metals for Specified Temperature Changes (Approximate)

Metal	Contraction per Inch of Length or Diameter from Room Temperature (70 Deg. F.) With Liquid Air (—310 Deg. F.)	With Solid CO_2 (—110 Deg. F.)	Expansion per Inch from Room Temperature to 212 Deg. F. (Heat of Boiling Water)
Aluminum	0.0038	0.0018	0.0018
Brass	0.0031	0.0015	0.0015
Bronze	0.0038	0.0018	0.0014
Cast iron	0.0018	0.0008	0.0008
Copper	0.0029	0.0014	0.0012
Monel	0.0025	0.0012	0.0011
Nickel	0.0021	0.0010	0.0010
Steel	0.0020	0.0009	0.0008

Sliding Fits

The inner part, when fully cooled, should slip easily into the outer without forcing or driving, at least with a sliding fit. In such cases, most of the restrained expansion of the inner part is used in intensifying the grip of the fit. For expansion fits of 6 in. diameter and less, good results are usually obtained when fit allowances are such that inner parts, when fully cooled, are sliding fits in holes in outer parts. Recommended sliding fit allowances and tolerances are given in Table II. A fit of this type is obtained by machining the inner part at room temperature to a diameter larger than the hole in the outer part, or oversize, by the amount which the inner part will contract in the refrigerant (Table I) less the sliding fit allowance (Table II). For example: A brass bushing is to be expanded into a 2-in. hole in a casting, after cooling in liquid air. To what diameter should the bushing be machined? 0.0031 (Table I) × 2 in. gives total contraction of 0.0062 in., less the sliding fit allowance (Table II) of 0.002 in. gives 0.0042 in. oversize of bushing. Machine to 2.0042.

Compound Fits

Where fit diameters are too small for satisfactory expansion fits, or where an unusually powerful grip of fit is specified, compound fits are sometimes employed. These are accomplished by cooling the inner part and simultaneously heating the outer (usually in water to its boiling point of 212 deg. F.). This gives a total temperature range of 320 and 520 deg. respectively for solid CO_2 and liquid air. When assembled, the inner part expands as the outer contracts, producing the compound effect. As with expansion fits, fit allowances may be such that inner parts, when fully contracted, are sliding fits in holes in *heated* outer parts. Table I also gives approximate expansion of various metals per inch of length or diameter from room temperature to the boiling point of water. The machining allowance is determined similarly, but with the allowance made for the increase in the expanded hole. Thus: A hardened steel bushing is to be compound-fitted into a thick cast-iron pedestal with 3½-in. diameter bore. Expansion of the hole (Table I) is 0.0008 × 3.5 in. = 0.0028 in. total expansion of hole. Thus its diameter at 212 deg. F. would be 3.5028 in. The bushing would contract meanwhile to (Table I) 0.002 × 3.5028 = 0.007 in. Less sliding fit allowance (Table II) of 0.003 in. gives 0.004 in. as the amount the bushing should be oversize in the expanded hole. This, plus the diameter of

© American Machinist

American Machinist
Reference Book Sheet

EXPANSION AND COMPOUND FITS BY REFRIGERANTS

the hole *at 212 deg. F.* gives 3.5068 in., the diameter to which the bushing should be machined.

Cautions

Remove all grease, oil, etc., from parts before placing them in refrigerant, and if it is liquid air, keep open flames away. Do not allow the refrigerant or cooled part to come in contact with the skin—it should be handled exactly as though it were hot. Use parts immediately upon removal from the refrigerant, otherwise they will become frosted over. If this occurs, put them in the refrigerant again until it disappears. If liquid air is used, be sure containers are clean, keep them filled at a fairly uniform level, and do not use too much or it will be wasted by splashing and "boiling" over. Insulation for working containers should be materials of mineral origin such as slag or mineral wool, asbestos, or infusorial earth.

Quantity Required

The amount of refrigerant required is a variable quantity, since this depends largely upon the kind of container used, the size of the parts, and a variety of other considerations. Both refrigerants maintain their low temperatures until entirely evaporated. For expansion fit practice, it may be assumed that 90 B.t.u. are required to evaporate a pound of liquid air. No similar factor for solid carbon dioxide is available. Shape of the part has no effect on refrigerant required—the material, its weight and the temperature difference are the determining factors. If the part presents a large heat radiating surface, such as does a thin plate, it will cool much more rapidly, but the heat given off is the same as that given off by a sphere of the same weight—which has the least surface in proportion to its volume. Normally, use enough liquid air or carbon dioxide to surround the part completely. Liquid air is shipped in containers of 25 litres and larger, and in these containers loses about 4 to 8 per cent of its volume per 24 hours. These losses are increased during transportation due to the motion of the liquid. The containers *must be open*—if closed the vapors are allowed to build up the pressure until the container is a potential explosive of enormous force. Solid carbon dioxide is usually shipped in corrugated carboard boxes, the usual commercial weight being a 10x10x10-in. block that weighs about 50 lb. Solid carbon dioxide is often crushed or broken and placed in a bath of acetone, ethylene glycol, alcohol, or some other "anti-freeze" in order to obtain closer contact with the part being cooled, thus to speed up the operation. The liquid seems to aid in assembly also by acting as a lubricant.

Table II—Allowances or Tolerances for Sliding Fits

Fit Diameter, Inches	Allowance, Inches Close	Moderate
½	0.00025	to 0.0005
1	0.0005	to 0.001
2	0.001	to 0.002
3½	0.002	to 0.0035
6	0.003	to 0.005

Length of Time for Cooling

The length of time for cooling depends upon the type of container and its insulation, of course, since a varying amount of heat will be taken from the surrounding air. Parts put into liquid air should be left immersed until the "boiling" ceases. Boiling will be violent at first, then diminishes until just before action ceases, when it becomes very violent again. That is the "removal point." If solid carbon dioxide is the refrigerant, the time for a part to be left in must be determined by experiment. Liquid air has the greater speed of operation and produces double the contraction that solid CO_2 does, but is harder to handle.

Use in Production

A number of companies are using the expansio nfit process on a production basis. The most important requirement in using either refrigerant on a production basis is that the container be well insulated to avoid absorption of atmospheric heat by the refrigerant. Only in this way can the maximum heat-absorbing power of the refrigerant be realized. It is practical, whenever possible, to use the vapor given off by the refrigerant for precooling of parts. The vapor may be piped to a separate precooler or parts may be suspended in a wire-mesh or perforated basket in the upper part of the working container while the preceding batch is in the refrigerant. Exact working quantities for small parts can best be determined by test. Actual trial will also prove best in determining quantities of refrigerant to be used and stocked. Any refrigerant supplier has engineers capable of assisting in these determinations. It is essential that careful preliminary tests—including comparative tests with commoner processes—be made before this production method is adopted.

Strength of Fits

Fits with 0.001 allowance tested 2,000 lb. per sq.in. of surface area for pulling apart. This could be increased about 40 per cent by slight tapering of the pin. The actual load required to remove a 1.001 pin from a 1-in. hole was 6,000 lb.

Breaking Fits

Where inner parts are hollow or otherwise adapted, they can be immersed in or filled with the refrigerant and thus contracted before the outer parts have cooled. If performed rapidly, fits may sometimes be broken thus without the use of force.

Sources for this information include: U. S. Bureau of Standards, Air Reduction Sales Co., Liquid Carbonic Corp., Linde Air Products Co., Dry Ice Corp. of America, Pure Carbonic Co.

© American Machinist

EDITORIALS

March 3, 1932

K. H. CONDIT • F. H. COLVIN
Editors

Short Selling

Short selling of stocks and commodities is under fire and in danger of legislative curbing that has aroused the forebodings of economic theorists and market manipulators alike. The theorists are generally agreed that limitation of short selling would hamper open market activity. The manipulators would have a tough time making a living in a bear market if they could not sell short.

Aside from the academic aspects of short selling there is a very practical manifestation of it that affects manufacturers and other business men. This evil, for that is the proper name for it, arises from the circulation of adverse rumors by the shorts. The purpose of the rumors, of course, is to depress the market for the stocks or bonds of a given company so that the rumor-monger can cover at a fat profit.

In a depression period nervous tension is high and rumors spread rapidly. Before they can be denied they have done incalculable harm to the company, to its stockholders and even to its employees. Under such conditions academic aspects remain academic, and too drastic limiting legislation is likely to get considerable sympathy. Somebody has the job of framing regulation that will abolish the abuse and still maintain a free and open market.

Rut Elimination

Dry rot and deep ruts among the supervisory force in an organization can be prevented in considerable measure by transferring supervisors from one type of work to another. In one plant where such a policy is followed, a wholesome spirit of cooperation exists, and a group of supervisors have been trained to meet the common problems as they arise and with a minimum of buck passing. The present chief inspector was originally the tool supervisor, then changed to take charge of the paint shop, next the body shop and so to his present position. Lumber troubles in the body shop were eliminated by an executive trained in the tool shop; he did not know that some things "could not be done."

The supervisor of the gear department was made master mechanic, then supervisor of the assembly department and now is in charge of experimental engineering. The net result is a group of executives interested in the institution and aware of the technical and production problems all along the line.

Twenty Young Engineers

There once prospered in the City of Chicago a Big Process Industry. But Hard Times came upon the land, the Sales Curve played toboggan, and Twenty Young Engineers were sent in to see the Chief for their Swan Songs. But the Big Boss was a Wise Executive and a Sport, so he said, "The twenty of you cost the company $4,000 a month. You have no work now or immediately in sight. Rather than give you a month's Notice to hunt for New Jobs that probably you won't find, I am going to give you a 2-month Chance to see what you can do right here. Go out into the Plant and check up Everything in sight. See if you can't stop wastes or change Methods to save the $4,000 a Month the Company is paying you."

The Chosen Twenty went through that Plant with the Thoroughness of Grasshoppers in a wheat field. They found many Little Things whose sum total of Economy equaled their Salaries. In addition, and of Spectacular Significance, they discovered a means to reduce the use

of process steam from eight to three pounds per unit of Product at a saving of $25,000 *per month.*

Try that on your own youngsters.

• CHIPS •

President Hoover signs Glass-Steagall Bill . . . With this latest piece of constructive legislation, the Federal Government passes the buck straight back to American business and American citizenship . . . We now have the tools for genuine recovery, and it is up to all of us to use them . . . Federal Reserve of New York cuts rediscount rate from 3½ to 3 per cent . . . proves that crisis passes . . . 1931 income tax rates to prevail in March 15, 1932, returns . . . House Ways and Means Committee drops idea of special sales taxes in favor of a single general manufacturing sales tax of approximately 2 per cent . . . With winter about over, direct Federal relief becomes less of a possibility . . . Both Dun's and Bradstreet's report increased retail activity . . . Green renews demand for 35-hour week . . . Garner's plan for merging bureaus wins over Hoover's, with latter holding no ill will . . . Bond prices continue to firm and advance, doing more for general financial situation than a dozen assorted nostrums.

United Action Drive to "put one million men back to work" makes amazing progress. 100,134 men placed in full time jobs during first eleven days of campaign. This is not, as at first believed, an exclusive American Legion effort, but the joint drive of Association of National Advertisers, American Federation of Labor, and American Legion.

Great Britain's general 10 per cent tariff replaces "free trade" . . . exempts copper, cotton, wheat, corn and coal . . . France just coming into her depression with exports and imports down 50 per cent from January, 1930 . . . should have been forewarned by what happened to U. S. . . . Two-ring show now running in Geneva—disarmament and League of Nations . . . U.S.S.R. accuses Japan of arming White Russians and demands explanations . . . meanwhile begins to release details on second 5-year plan . . . China digs in for 1-year war . . . orders munitions, airplanes and trench-diggers from Germany . . . may assist German tool builders operating at 30 per cent capacity . . . Japan begins diplomatic tenders for neutral zone around Shanghai, but will refuse to relinquish Manchuria . . . English say Japan will not talk peace until she has won major victory in present fracas and saved face . . . New name for Manchuria will be Daido (great union) and not Ankuo (land of peace).

Court refuses receivership for Rolls-Royce of America, Inc. . . . considers company outlook encouraging . . . Pittsburgh steel producers to raise prices of bars, shapes and plates for second quarter . . . Eaton Axle Spring Company may change name to Eaton Manufacturing Company . . . F. A. D. Andrea, Inc., enters electrical refrigerator field . . . Kinner Airplane & Motor Corporation issues stock rights to secure additional working capital . . . General Railway Signal buys assets of Railroad Supply Company, excepting those of tie plate division . . . Phelps Dodge sets up two separate manufacturing units —National Electric Products Corporation and Phelps Dodge Copper Products Corporation.

Proposed that Congress withdraw tariff protection from active industries that fail to sustain wages.

Ford reports 83,560 unfilled orders with cash deposits for his new models . . . will begin production this week on 1932 schedule calling for 1,800,000 cars . . . will mean $300,000,000 for materials, labor and supplies . . . American Brass books 800,000-lb. brass pipe order . . . Chriscraft shipments during first 15 days of February three and one half times greater than entire Month of February, 1931 . . . Orders for Caille Motors since Show double any similar period in company's history.

Reported that the ironwood in Garner's sixty-first new gavel is so hard that "special machine tools were necessary to model it." Who were the lucky machine tool builders?

Seamon Body increases Milwaukee payroll from 1,700 men to 3,200 . . . Wheeling & Lake Erie shops at Massillon, Ohio, recall 200 men . . . Colt's Patent Fire Arms Mfg. Company increases working schedules . . . Rutenber Electric Company goes into capacity production, adding 40 per cent to payroll . . . Fletcher Enamel Company adds 125 men . . . Warner Gear, 200 . . . Marmon, 307 . . . P. R. Mallory & Company, 250 . . . Remington Noiseless Typewriter Company recalls unascertained number of employees to care for increased demands.

· REGIONAL · REPORTS ·

FAINT indications of betterment are in evidence in the country's machinery and machine tool markets . . . Whether they will strengthen or again fade lies with general business and the results of present governmental and private efforts to strengthen the economic situation . . . Automotive buying still expected, still fails to come . . . Industrial demand in general is sparse.

NEW YORK dealers are selling a few tools, some to industrial sources; inquiries are slightly improved, sentiment is better . . . New England has occasional important orders and inquiries, with Navy and General Electric buying, freight and passenger bus companies interested . . . Buffalo sees slight indications of improvement, with some manufacturers in better production than for several months past . . . Electrical trade better; demand for contractor's equipment off . . .

DETROIT considers present the worst period of the depression, construes it as indication of forthcoming advance; present sales dominated by price considerations; some sales to jobbing shops . . . Cincinnati builders and dealers answer many inquiries, get few results . . . Russian and Jap order rumors appear unfounded.

CHICAGO business maintains its low level, and no immediate change for the better is expected . . . February business is down; current orders all small single tools . . . Indianapolis, likewise, shows no indications of betterment, though dealers there expect railroad business soon and are watching the automobile builders closely . . . Canada sees faint but unmistakable signs of recovery, with metal-working operations up from 20 in January to 28 per cent now . . . Tool sales are slightly better, prospects still better.

NEW YORK—A little more pep, a few more orders, even some industrial inquiries in evidence. One dealer sold a small brake; has inquiries for a brake, shear and radial. Another sold a repair tool or part here and there; a small dealer had a few orders for small tools, sees some prospect of getting more shortly.

NEW ENGLAND—Occasional important orders and inquiries feature machine tool market. Navy department continues inquiries for assortment of tools. Freight and passenger motor carriers interested in shop equipment, but no substantial orders placed. General Electric places some business. Automotive industry buying sparingly.

BUFFALO—Slight indications of improvement in western New York machine tool trade during second week in February. Some manufacturers producing at greater volume than for months past. Business in electrical trade improved. Demand for contractors' equipment at low level. Construction practically at standstill.

DETROIT—Business in general, machinery and machine tool business in particular, in worst period of depression. Construed as forecast of long-awaited advance in motor car industry. Price still dominating consideration in the few machinery and machine tool sales. Occasional sales of equipment for contract jobbing shops. More salesmen employed in 1931 than in 1930. Ford and some other large manufacturers will need considerable equipment if they get into large scale production this year.

CINCINNATI—Machine-tool manufacturers and selling agents do little except answer plenty of inquiries, few of which make sales. Orders scattered geographically and well diversified. Majority for single tools. Fair-sized inquiry from Japan went flat. Rumor Russian buyers here a few days ago to purchase million dollars worth of tools cannot be traced to any reliable source.

CHICAGO—Business in machine tools and machinery continues at same low level as last several months. No change for better expected. Inquiries few and scattered. Sales, exception some lines of small tools, almost negligible. Closing discouragingly slow. Railroads, farm implement makers and industrialists in general, awaiting favorable outlook. February business down.

INDIANAPOLIS—No indications of any immediate improvement in the machinery or machine tool business. Sales generally for small items and not too many of them. Little big stuff. Automobile trade watched closely. Indications of improvement in business from accessory and parts manufacturers. Indiana factories supplying gears, differentials and such equipment report better outlook. Some already have fair volume of business, but are cautious in tool buying. Opening of large motive repair shops of Big Four here in February gives rise to hope for railroad tool sales.

CANADA—Faint but unmistakable signs of recovery appear on Canada's industrial and economic horizon. Slightly upward turn in machinery and machine tool market. Metal-working plants busier than fortnight ago. Railways enter market for necessary replacement tools. Prospects for steel industry brighter. January operations dropped to 20 per cent of normal, February up to 28 per cent. Some units reached 40 per cent. Automakers active, agricultural machinery increases, prospects point to big demand for mining machinery this summer.

MATERIAL TRENDS AND PRICES

Steel mill operations, at 27 per cent of capacity, are back to where they were Oct. 31, 1931; a year ago the rate was 52 per cent of capacity. Current demand consists for the most part of light flat-rolled products and track accessories. Heavy-finished materials continue to move slowly, with automotive and structural buyers holding off. Non-ferrous metals except copper, held firmly during the last week, while the price of tin advanced 1.05c. per lb. at New York. Copper is off ¼c. per lb., to 6c., which restores the price to its level as of Feb. 12, 1932. Prices of scrap non-ferrous metals dropped sharply in the Chicago market.

(All prices as of Feb. 26, 1932)

IRON AND STEEL

Pig Iron —	Current	Mo. Ago	Yr. Ago
Birmingham, No. 2, Fdry., per gross ton	$10@$11	$10@$12	$14.00
Buffalo, No. 2, Fdry., per gross ton	14@15	15@16	17.50
Heavy Melting Steel Scrap — Pittsburgh consuming point, No. 1, per gross ton	10.00	10.00	12.75
Furnace Coke — Connellsville, per net ton	2.25	2.25	2.40
Foundry Coke — Connellsville, per net ton	3.25	3.25	3.25
Steel Shapes — Pittsburgh, base, per 100 lb.	1.50	1.50	1.65

Iron Machinery Castings — Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight, 275 lb.

Chicago	4.62½	Cleveland	4.50	New York	4.75
Cincinnati	4.35	Detroit	4.00		

Steel Sheets — Prices in cents per lb., del. from warehouse stock (except at Pittsburgh) in lots of 401 to 999 lb., ordered and released for shipment at one time:

	Pitts. Mill	Chicago	Cleveland	New York
Hot-rolled, No. 10	1.85	3.20	3.00	3.00
Hot-rolled, No. 24	2.40	3.55	3.25	3.50
Galvanized, No. 24	2.90	4.10	3.75	4.00

Seamless Steel Tubing — Cold-drawn mechanical tubing, round, .10 to .30 carbon, in lots of less than 100 ft. or 100 lb., net, at N. Y. warehouse:

— Thickness — of Wall		Outside Dia. in Inches					
		⅛	¼	½	1	1¼	1½
Inches	B.w.g.	Price per Foot					
.035	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23

Shapes, Plates, Bars, Etc. — Warehouse base prices in cents per lb., del. in lots of 401 to 999 lb., ordered and released for shipment at one time:

	New York	Cleveland	Chicago
Bands	3.40	3.00	2.95
Bars, soft steel	3.10	2.75	2.75
Cold fin., flat or square	3.80	3.60	3.60
Cold fin., round or hexagon	3.30	3.10	3.10
Cold rolled strips	4.95	6.00	5.50
Floor plates	4.85	5.00	5.00
Hoops	3.75	3.65	3.50
Rivets	4.00	4.00	4.00
Shapes	3.10	2.95	3.00
Spring steel	4.00	4.00	4.00
Tank plates	3.10	2.95	3.00

Stainless Steel — Hot-rolled bars, base, Pittsburgh, 0.12 per cent carbon, cents per lb.:

Chromium		Chromium	
15% and under	19.00	18 to 23%	23.00
15 to 18%	20.50	23 to 30%	28.00

Bolts and Nuts — Discount from list, f.o.b. mills, Birmingham, Chicago, Cleveland and Pittsburgh, on bolts (except tire and stove) nuts, and lag screws, mill lots 73–10–10%

NON-FERROUS METALS

Prices following are in cents per lb. for mill shipments in carlots:	
Aluminum ingots 99%, N. Y.	23.30
Copper, electrolytic, Conn	6.00
Copper wire, base, Chicago and Cleveland	8.62½
Copper wire, base, N. Y.	8.50
Lead, pigs, E. St. Louis	3.55
Tin, Straits, pigs, spot, N. Y.	22.20
Zinc, slabs, E. St. Louis	2.82½
Prices following are in cents per lb., base, N. Y., Chi. and Cleve.:	
Brass rods, high	10.6½
Brass sheets, high	12.8½
Brass tubing, high	13.12½
Copper, drawn round	13.37½
Copper sheets	15.87½
Copper tubing	15.37½
Prices following are in cents per lb., del. from N. Y. warehouse:	
Babbitt, anti-friction, general service	28.50
Babbitt, com'l, intermediate grade	34.25
Babbitt, genuine, highest grade	43.00
Solder, bar	17.25
Prices following are in cents per lb., base, Huntington, W. Va.:	
Monel metal rods, hot rolled	35.00
Monel metal sheets, full finished	42.00
Monel metal tubing, seamless	65.00
Nickel rods, hot rolled	45.00
Nickel sheets, full finished	52.00
Nickel tubing, seamless	75.00

Scrap Non-Ferrous Metals — Dealers' purchasing prices in cents per lb., f.o.b. cars:

	New York	Cleveland	Chicago
Heavy yellow brass	2.50	2.00	1.75
Light brass	2.00	1.50	1.50
No. 1 rod-brass turnings	2.75	2.50	1.75
Heavy copper	5.00	3.50	3.00
Light copper	4.00	3.00	2.50

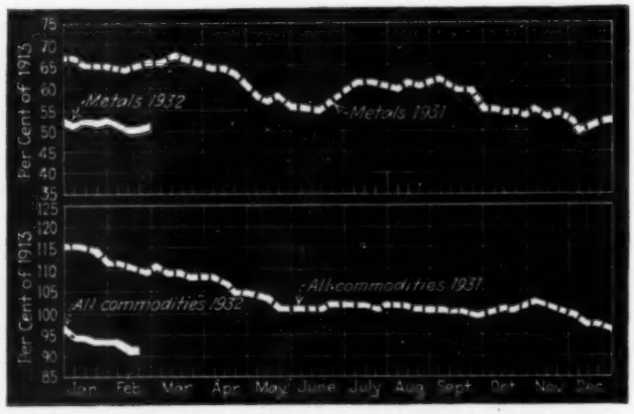
SHOP SUPPLIES

(Prices at warehouse)	New York	Cleveland	Chicago
Abrasive disks, aluminum oxide No. 50 grain, cloth, 6-in. dia., X weight, per 100	$4.37	$4.59	$4.59
Belting, leather, heavy	40%	40%	40%
Belting, rubber, trans., Grade 1	60–10–10%	60–10%	60%

Lumber — Per M ft., b.m., 12–16 ft. lengths, delivered, N. Y.:

Crating — Southern pine:
1x4-in. ..... $27.00 1x6-in. $26.00

Skids — Spruce:
2x4-in. .$25.00 3x4-in. .$35.00 4x6-in. .$37.00 6x6-in. .$50.00


Per Cent of 1913
Metals 1932
Metals 1931
All commodities 1932
All commodities 1931
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec

Price Movements Week by Week

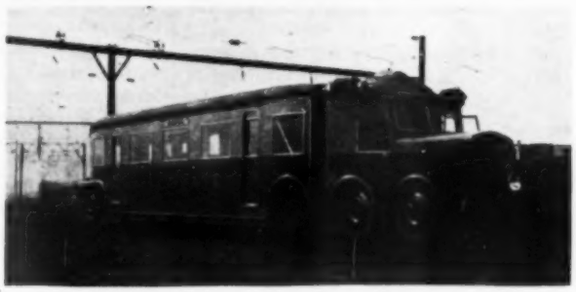
Average Price of Raw Metals: Pig Iron, Billet Steel, Copper, Tin, Lead, Zinc—American Machinist
Seventy-Four Commodities Index—The Annalist

Tool Builders Hold Third Regional Meet

THE EXECUTIVES of the machine tool industry gathered in Chicago last Wednesday for the third regional meeting of the National Machine Tool Builders Association. As in the previous meeting the morning was devoted to reports of Association activities. A. G. Block of the Barnes Drill Company presented the Completed Cost Manual. G. E. Randles of the Foote-Burt Company brought the members up to date on the progress of the 1932 Exposition and Mrs. F. F. Selbert analyzed the Association Index of Orders. Space in the Exposition was reported as entirely sold, with 65% of the cash in the bank, an indication of confidence on the part of the machine tool industry, which was further endorsed by a unanimous vote of the meeting.

The afternoon was organized around the theme of modernization and included a report by Earl Whitehorne of the McGraw-Hill Publishing Company on the movement for modernization of industrial equipment, now being developed by the business press. George H. Johnson of the Gisholt Machine Company talked on obsolescence in machine tool builders' plants, stating that the dominant interest of the machine tool builder in saving money for his customer has caused him to neglect sometimes the efficiencies of his own plant and the profits from his own operations. He discussed economies of using old machines on part time operations and replacing for maximum efficiency on equipment in more constant uses. Robert M. Gaylord of the Ingersoll Milling Machine Company and president of the Association, in advocating needed adjustments to suit present business conditions, urged that the industry be provided with more adequate statistical knowledge of its own operations. At present there is no basis for estimating the total investment in the machine tool industry, total sales or average earnings. Without such statistics, economic standards of the industry suffer.

A general discussion of Ethical Sales Standards Today followed, participated in by D. B. Burleigh of Sundstrand Machine Tool Co., W. D. Creider of the Oilgear Co., S. Owen Livingston of the Gallmeyer & Livingston Co., and H. B. Kraut of Giddings & Lewis.



American production methods are applied in the manufacture of the Budd-Micheline rail car above, an adaptation of the original French model shown below. See page 802 for story

Metal-Working Machinery Shows Export Decline

POWER-DRIVEN metal-working machinery valued at $835,958 was exported during January, 1932. This is a decrease from $2,762,546, the total value of exports in January, 1931. The one item showing an increase was vertical boring mills and chucking machines. Exports in January, 1931, were four and one-half times greater than those of January, 1930. The detailed figures, compiled by the Commerce Department, follow:

	January 1931	January 1932
Engine lathes	$169,005	$21,018
Turret lathes	67,318	11,975
Other lathes	148,692	26,675
Vertical boring mills and chucking machines	18,154	82,055
Thread-cutting and automatic screw machines	30,418	22,429
Knee and column type milling machines	45,214	.....
Other milling machines	67,803	17,066
Gear cutting machines	46,656	24,112
Vertical drilling machines	26,180	10,316
Radial drilling machines	11,829	4,840
Other drilling machines	101,539	33,491
Planers and shapers	140,702	25,407
Surface grinding machines	21,466	15,330
External cylindrical grinding machines	59,793	19,127
Internal grinding machines	46,047	36,704
Tool-grinding, cutter-grinding and universal grinding machines	47,776	17,247
Other metal-grinding machines	106,604	13,643
Sheet and plate metal working machinery	413,478	40,302
Forging machinery	252,428	100,731
Rolling mill machinery	381,258	18,776
Foundry and molding equipment	233,171	18,775
Other power-driven metal-working machinery	327,015	276,539
Pneumatic portable tools	69,760	32,477
Chucks for machine tools	7,819	2,801
Machine-operated pipe and thread cutters, stocks, dies and taps	119,376	30,477
Other metal-working machine tools	67,896	23,747

Exports in the machinery group in January were valued at $18,765,907. In January, 1931, exports in this group aggregated a value of $54,063,702. The decline was generally distributed throughout the list. The group figures, compiled by the Department, follow:

	January 1931	January 1932
Electrical machinery and apparatus	$6,863,150	$3,641,042
Power generating machinery, except electrical and automotive	986,920	471,011
Construction and conveying machinery	994,522	342,121
Mining, well and pumping machinery	4,443,885	860,212
Power-driven metal-working machinery	2,762,546	835,958
Other metal-working machinery	311,677	113,968
Textile machinery	558,104	487,089
Sewing machines (domestic)	158,219	106,371
Sewing machines (industrial)	234,050	216,579
Other industrial machinery	4,414,529	1,615,994

Watson-Stillman Gets Foreign Tool Rights

E. A. Stillman, president of Watson-Stillman Co., Roselle, N. J., and president of Machinery Club of the City of New York, has recently returned from a business trip to England Germany and France. While in England he obtained American rights to the Henley Straight Through Lead Sheathing Presses, also an agreement with Davy Brothers of Sheffield covering the manufacture of Watson-Stillman equipment in England and the manufacture in the United States of certain of Davy Brothers' hydraulic equipment.

G. E. Donations Cut

Employees of General Electric Co., who since Nov. 1, 1931, have been contributing two per cent of their average full-time earnings toward the relief of part-time workers and the unemployed within the company, will have but one per cent deducted from their pay, starting March 1, according to announcement by PRES. GERARD SWOPE. During this four-months period, employees have contributed $480,000.

Foundry Equipment Orders Decline

Net orders for January, as reported by the Foundry Equipment Manufacturers' Association, indexed at 20.5 on the base of average monthly shipments for 1922-24 taken as 100. Shipments were at 28.8 and unfilled orders at 29.1

Material Testing Spotlighted at New York Welder's Meeting

SEVEN hundred engineers gathered Feb. 18 in New York to discuss fundamental problems relating to testing of engineering materials, principally metals, and to witness demonstrations of ten different methods of testing welds. Included in the groups were local and national groups of the A.S.T.M., A.I.M.E., A.W.S., and A.S.S.T.

Two addresses preceding the demonstrations dealt with the philosophy of testing rather than with technical details. The speakers were F. O. CLEMENTS, president, A.S.T.M., and technical director of the General Motors Research Laboratories, and H. F. MOORE, research professor of engineering materials, University of Illinois. They agreed that what we do not know is the most important knowledge.

There are 64 metallic elements, Mr. Clements pointed out, the number of possible alloys running into the billions. The field is so vast that progress by mere cut and try methods will leave undiscovered many practically important alloys. When we really understand the atom and the molecule, Mr. Clements said, we shall be in a position to design alloys at will to fit almost any required classification. There would be a tremendous field, he pointed out, for alloys having a high ratio of strength to weight, for a metal with a higher modulus of elasticity than steel, for metals that would retain their strength better at high temperatures, for very light metals with high resistance to corrosion, for successful corrosion-resisting alloys of tantalum and iron, for method of plating baser metals with tantalum or columbium, for a means of softening tungsten so that it could be machined and then hardened again. Greater fundamental knowledge will hasten such developments.

No Test Result Infallible

Professor Moore, widely known for his work in the materials testing field, warned engineers that test results should not be accepted uncritically. A laboratory test, he said, is the engineer's attempt to compress into ten minutes or a day the result of many years of actual service. A test result may or may not be a measure of serviceability. It may be such a measure to a slight extent or to a great extent. Until the engineer knows from service experience the actual significance of any test methods, he should use his results with caution. "In our modern world," says Professor Moore, "there has grown up what is almost a popular superstitious reverence for test results obtained by the use of apparatus on which results may be repeated over and over when that apparatus is handled by skilled laboratory technicians."

In stressing specific tests, Professor Moore showed that such ductility measurements as elongation, reduction of area, and various bend tests are not as closely related to service conditions as some imagine. Machine parts, for example, are rarely expected to yield to any such extent as test specimens. It is extremely difficult, he pointed out, to approximate service corrosion action in a short laboratory test. The simple word "impact," as applied to impact tests, covers a mass of ignorance because nobody knows just how fast the load must be applied to become impact. He warned against judging the fatigue limit of a material from its elastic limit.

In conclusion, he said, "Let every testing engineer keep alive his interest in and his study of the technique of testing and also the service significance of test results."

Following these addresses, A. B. KINZEL and W. B. MILLER, of the Union Carbide & Carbon Research Laboratories, and JOHN J. CROWE, of the Air Reduction Sales Co., used a portable testing machine and motion pictures to demonstrate ten standard tests for welds, four destructive and six non-destructive. By visual examination alone, Mr. Crowe stated, a fairly reliable idea of weld quality can be obtained. The inspector can tell whether the operator is using the proper tip, proper flame size whether he is melting down the parent metal. A fair idea of penetration can be obtained by inspecting the weld from the side of the bottom of the V. Mr. Miller demonstrated the nick break test. The specimen is nicked on two sides with a hacksaw blade and broken in a vise by a blow with a heavy hammer, after which the break is examined. This, he said, is a good rough and ready field test. In the free bend test, which he also demonstrated, the specimen is bent as a strut by a hydraulic jack and the resulting elongation of the outer fiber at the bend is measured. This test is easily made in the field. Mr. Kinzel also demonstrated a small field unit for tensile testing. Non-destructive tests exhibited included the Brinell and the Rockwell for hardness, and for specific gravity the stethoscope test in which important defects are located by listening to the sound when the specimen is struck with a hammer. The use of X-rays and gamma rays to reveal hidden defects was explained. Other steel tests included the drift test, in which the end of a welded tube is expanded by a cone, and the crush test, in which a short length of tube is collapsed like a bellows.

Shop-door deliveries from planes become an established fact—Century Air Lines adds delivery trucks to its airplane fleet

Export Auto Demand To Grow Steadily

Vast potential demand for automotive equipment abroad, which has followed rapid growth of motor transportation in foreign countries, is described in a new survey of foreign markets for automotive equipment, the first of its kind, which has just been published by the automotive division, U. S. Bureau of Foreign & Domestic Commerce. During the years 1924-1930, the survey points out, exports from the U. S. of automotive replacement parts, accessories and garage and service station equipment averaged more than $60,000,000 annually, attributed mainly to a predominance of American automobiles in many foreign markets, the steady increase in the total number of automobiles abroad; recognized quality of American parts; continuous development in this country of new and efficient equipment for servicing automobiles and increasing recognition in foreign countries of the value of service facilities, both as an aid to motor sales and an important source of revenue. Many foreign automobile dealers have only been able to stay in business through the revenue derived from their service branches.

Our exports of equipment increased from $31,627,000 in 1924 to $61,027,000 in 1930, with $88,664,000 worth shipped abroad in the record year, 1929. Total exports of replacement parts, accessories and service appliances during 1931 were valued at $37,732,780, a decline of $23,294,214 or 38 per cent from the $61,026,994 figure for 1930. Although showing a greatly lessened total, the

exports in these three classifications accounted for 23.4 per cent of the total valuation of our automotive exports, as compared with 20 per cent during the preceding year. Shipments of replacement parts declined $18,261,106 or 38 per cent, service appliances $2,605,677 or 33 per cent, and accessories $2,326,565 or 42 per cent. Replacement parts accounted for 18.21 per cent of total of automotive exports in 1931, as compared with 15.9 per cent in 1930. Service appliances were 3.25 as against 2.62 per cent, and accessories 2 as against 1.85 per cent.

The survey and analysis of 112 foreign markets shows that the trade in automotive equipment is relatively more stable than the trade in new vehicles. The survey concludes that the next decade will disclose a vast demand abroad for the type of equipment in which our automotive manufacturers have led the world for years. It is evident that the struggle to supply that demand will be marked by extremely keen competition both local and foreign. More careful foreign market analysis, judicious distribution practices and the ability to adapt export policies to the requirements of each market will be essential to the successful development of these markets.

THE BUSINESS WEEK

March 2, 1932

The level of industrial and commercial activity is still slowly subsiding, but a belated and possibly brisk Spring spurt is still expected as soon as the effect of the Administration's financial measures is felt and low-price automobile production gets under way . . . Steel and electric power output are still persistently depressed by delayed automotive demand, problematic price policies and unseasonable weather . . . A mild revival of rail demand and strengthening in second-quarter steel quotations are slightly encouraging indications that some seasonal increase in steel activity will not be lacking, though unusually late . . . Building contract figures for the first half of February are more hopeful than was expected . . . Merchandise carloadings, commodity prices, employment, as yet show no response to sanguine security market movements or the slight easing of the credit strain indicated in slackened hoarding, diminished member bank liquidation and the first upturn in commercial loans for many months . . .

Although European conditions continue in a delicate balance which may be upset at any time by approaching elections, League and reparations conferences, the domestic picture appears to offer prospects of at least temporary stabilization and improvement during the next quarter, with a possibility of slow progress toward reconstruction from that point on.

© The Business Week

Discounts Fatigue as Accident Cause

The increase of industrial accidents in the late afternoon is not due to fatigue, as has been generally thought, but to the worker's looking forward impatiently to the pleasures of the evening, according to Dr. Morris S. Viteles, assistant professor of Psychology at University of Pennsylvania, who addressed one of the sessions of the third annual Greater New York Safety Conference at Hotel Pennsylvania, New York, Feb. 24. More than 1,700 persons attended the various meetings.

Studies show that the same accident increase is not found in the corresponding hours of the night shift, Dr. Viteles said, which indicates that fatigue is not to blame. The night worker can look forward only to going home to breakfast and bed, since "it is not customary to make dates in the morning and the theatres are not open."

"Accidents don't distribute themselves by chance," he declared, adding that some persons are prone to have accidents while others are not. Dr. Viteles stressed the importance, for curing the "accident habit," of finding out what underlies an individual's susceptibility to them.

Mechanical guards and mass education are essential to a program of industrial safety, Dr. Viteles said, but to these must be added correction of individual susceptibilities. He told of attempts to do this that had been made in the transportation industry, particularly of one case where forty-one out of forty-four men had decreased their accident rates after their difficulties had been studied and attacked.

Thomas J. Watson, president of the Merchants Association, declared in a paper read in his absence that "in the reduction of accidents we have not made the progress that we should have made." The accident death rate increased 15 per cent from 1922 to 1929, he pointed out, even with the efforts to improve safety measures.

"Sufficient stress has not been laid on the fact that greater progress in accident prevention will be brought about mainly through executive consideration, as is the case with the other major functions of management, such as financing, engineering, production and marketing. Through executive consideration there should be formulated a specific company policy and plan of organization, indicating definite activities and responsibilites for each department in its relation to accident prevention."

Lack of attention to work, the physical condition of the worker and lack of proper training were listed as the fundamental causes of most accidents by W. Graham Cole of the Metropolitan Life Insurance Company.

Dr. Louis Schwartz of the United States Public Health Service estimated that eye cases made up 10 per cent of the 3,000,000 accidents incapacitating workers for one day or more each year, and that they cost a total of $50,000,000 annually.

T. P. Sylvan, vice-president of New York Telephone Co., advocated first aid training as the first step in an accident prevention program because, he said, it makes people "safety-minded."

The conference was under the auspices of the Metropolitan Chapter of the American Society of Safety Engineers, the Engineering Section af the National Safety Council, and forty-seven cooperating organizations.

Tool Steel Treating Meeting Subject

Treatment of tool steel, particularly die steel, was the principal problem discussed and considered by the A.S.S.T. Subcommittee on the Heat-Treatment of Tool Steels at its recent meeting in Pittsburgh. The meeting was devoted to preparing recommended practices for the heat-treatment of dies to supersede the present practice on the Heat-Treatment of Plain Carbon and Alloy Steel Die Blocks, now in National Metals Handbook. This series of heat-treating practices will cover die blocks, cold-heading dies, and silverware dies.

Materials Handlers' Committee Meets

The Publicity and Educational Committee of the Materials Handling Institute held its first meeting Feb. 12 at Detroit. Plans were discussed and a definite program of educational work outlined and acted upon, details of which will be announced later. Jervis B. Webb, vice-president, and Henry W. Standart, treasurer, of the Institute, met with the committee, the members of which are: W. V. Casgrain, president Mechanical Handling System, W. C. Peak, secretary of Service Caster Co., S. W. Gibb, assistant sales manager, Yale & Towne Mfg. Co.; and John R. Booher, advertising manager, Cleveland Tramrail, as chairman. The Institute roster to date shows a list of 66 companies as having signified their intention to become members, the majority of whom have sent in their checks in payment of annual dues.

Aluminum Research Bureau Founded

The International Aluminum cartel has formed a new research bureau at Basle, Switzerland, to be known as Alliance Aluminum Compagnie, with a capital of 35,000,000 Swiss francs which may possibly be increased to 65,000,000. Its shares are held entirely by members, including France, Switzerland, Great Britain, Germany, Norway and Canada. The Alliance will seek new uses for aluminum, better distribution, development and other ways for reducing the price of the product. Fabrication research is also to be included.

Phelps-Dodge Changes Set-up

Division of the manufacturing business of Phelps Dodge Corp., third largest copper producer, into separate units to be conducted by two subsidiary corporations has been announced by LOUIS S. CATES, president of Phelps Dodge. The development represents one of the final steps in the company's reorganization, acquisition and integration program, which included previously the absorption of important producing and fabricating groups. Under the latest phase of the plan the name of the present fabricating subsidiary, National Electric Products Corp., will hereafter be the corporate title of the national metal molding division of the company only. National Electric Products will have its headquarters at Pittsburgh and will be under direction of H. C. ROBINSON, president. Its plant is at Ambridge, Pa. A new corporation, named Phelps Dodge Copper Products Corp., headed by WYLIE BROWN as president, will take over and operate the other fabricating divisions of Phelps Dodge. These include the American Copper Products division, with mills at Bayway, N. J.; the British-American Tube division, also with mills at Bayway; the Inca Manufacturing division, with plants at Fort Wayne, Ind., and the P. M. G. Metal division. These manufacture a complete line of brass, bronze and copper products for electrical and other industries. Habirshaw Cable & Wire Corp. of which WYLIE BROWN also is president, will operate as a subsidiary of Phelps Dodge Copper Products. Habirshaw has plants at Yonkers and Hepperhan, N. Y., and at Bridgeport, Conn. In consequence of these changes both Phelps Dodge Copper Products and the Habirshaw unit will, on March 21, move their present offices to 40 Wall St., New York City, adjacent to the offices of the parent company.

• BUSINESS ITEMS •

The Milwaukee plant of Seamon Body Corp., maker of bodies for Nash cars, is adding approximately 1,500 men to its present force of 1,700. Two hundred men were added to the Ford plant in Milwaukee in the last two weeks, and 400 more will be added in the immediate future.

The payroll at the Cadillac-La Salle plant in Detroit averages about 6,300, and is approximately the same as during the peak months of 1929. Sales for the first ten days of February increased 78 per cent over the same period in January, and 14 per cent over last year.

Ford Motor Co. has been awarded the post office contract for 2,000 automobile chassis, 500 to be supplied at a cost of $215 each and 1,500 at $352 each. General Motors Corp. will supply 1,500 bodies at $149 each and Hifflenburg Body Co., Philadelphia, 500 bodies at $114 each.

Highway Trailer Co. has booked an order from Kroger Grocery & Baking Co., Cincinnati, for a fleet of 50 large-sized trailers with full automatic electric cab control in the tractor hauling unit.

Canadian production of automobiles during January was 3,731 cars, compared with 2,432 cars in December. Output in January, 1931, was 6,496.

Two hundred employees of Wheeling & Lake Erie Railroad shops at Massillon, Ohio, have been called back to work, after being idle since December.

Colt's Patent Fire Arms Mfg. Co., Hartford, Conn., has increased working schedules.

P. R. Mallory & Co., 3029 E. Washington St., Indianapolis, Ind., is adding 250 men, according to F. S. WILLIAMS, vice-president. Removal of equipment and machinery of Yaxley Mfg. Co. from Chicago to the Indianapolis plant has been completed. Yaxley, acquired several months ago, manufacturers radio parts and accessories.

Remington Noiseless Typewriter Co., Middletown, Conn., a Remington-Rand subsidiary, is recalling a large number of employees because of increased production demands.

Terre Haute (Ind.) Malleable & Mfg. Co. has increased its working force, calling back many old employees temporarily suspended. It has started another furnace and increased employees 20 per cent.

The Anderson plant of Baldwin-Ames-Wyoming Shovel Co. has been closed indefinitely. Activities have been transferred to the Parkersburg (W. Va.) plant for the present. E. T. NIPHER, local superintendent, was made a traveling manager of all Western plants of the new company.

W. B. BLAKE, general manager of Rutenber Electric Co., Marion, Ind., has announced that the factory will increase the number of employees 40 per cent and will begin operations at capacity as a result of the adoption of an electric range of its manufacture as a "leader" sales item by American Gas & Electric Co.

The Granite City (Ill.) plant of National Enameling & Stamping Co., is running three 8-hour shifts, with orders on hand to keep the plant going at capacity for three months.

Pressed Metals, Inc., Toronto, Ont., has stepped up operations to 16 hours a day because of an extensive contract to supply a motor car company with spring shackles.

Foote Bros. Gear & Machine Co., Chicago, has recently been awarded contracts for furnishing machined castings, including segmental, break in floor, center lock castings, etc., also operating machinery for the four bridges of the Illinois Waterway at Joliet.

American Hardware Corp., New Britain, Conn., and its subsidiary, P. & F. Corbin Co., will supply all the builders' hardware to be used in the construction of the proposed Radio City, New York. The New Britain companies are thus assured work stretching over a period of years.

U. S. Pipe & Foundry Co. has orders for the following: 1,500 tons of 6 to 12-in. pipe for St. Paul, Minn.; 630 tons of the same for Ft. Worth, Texas; 3,000 tons, some dimensions, St. Louis County, Mo.

American Brass Co., Waterbury, Conn., has booked a contract for 800,000 lb. of Anaconda No. 85 red brass pipe for a Long Island hospital.

A program for 1932 providing "jobs for 10,000 men and $24,000,000 to spend" has been announced by RALPH SIMPSON, assistant director of the Indiana State Highway Department. Five thousand men will be put to work in maintenance, and an equal number will be employed in new paving work. This will, of course, mean road equipment orders.

New Plants and Purchases

American Cooling & Refrigerating Systems, Inc., Wisconsin Rapids, Wis., has been organized to take over the plant and machinery of National Carbonic Machinery Co., Wisconsin Rapids, pioneer maker of heavy-duty refrigerating plants. The concern is capitalized at 4,500 common shares with no par value. Incorporators include R. B. GRAVES, T. W. BRAZEAU and ROBERT GOGGINGS.

Gardner-Denver Co., Quincy, Ill., and Denver, Colo., will henceforth produce its pumps, compressors, drills and similar equipment for the Canadian market at the plant in Toronto of its Canadian subsidiary, Gardner-Denver Co. of Canada, Ltd.

LaPlant-Choate Mfg. Co., Inc., Cedar Rapids, Iowa, has closed a contract with National Steel Car Co. Ltd., Hamilton, Ont., to take over exclusive manufacturing and sales rights for its products in Canada.

Northrop Corp., Los Angeles, Calif., has been formed by officers of Douglas Aircraft Co. and founders of Northrop Aircraft Corp., Ltd., to manufacture airplanes and parts.

CHARLES N. STODDARD
New President, Greenfield (Mass.) Tap & Die Co.

Industrial Casting Corp., Council Bluffs, Iowa, has been incorporated, capitalized with 1,500 shares of no par value. C. M. STOFFEL is president and JOHN D. LYNCH, secretary. The firm is authorized to do a general manufacturing business in metals, alloys, castings, tools and materials and to manufacture and produce from such materials.

McQuay-Norris Mfg. Co., St. Louis, Mo., specializing in the manufacture of piston rings, will begin immediately erection of a first factory unit in Toronto, Ont., to cost around $60,000. The complete plant, which it is stated will include six units and cover four acres, will cost in the neighborhood of $500,000 and give work to several hundred. NELSON A. HARDIE, Canadian representative, will be manager of the new plant.

Portable Machinery Co. of Illinois, subsidiary of A. B. Farquhar Co., York, Pa., has been organized at Chicago and is occupying a building at 4444 Elston Ave. for an assembly and stock parts plant for the company's freight handling conveyors. R. F. TOMLINSON, vice-president, has been placed in charge.

United-Carr Fastener Co., Hamilton, Ont., will purchase the fastener and grommet division of St. Lawrence Steel & Wire Co., Gananoque, Ont. The company is also installing machinery to manufacture certain electric equipment hitherto imported from the United States.

S. O. S. Co. and its subsidiary, Eagle Steel Wool Co., 3500 S. Morgan St., Chicago, will occupy a 1-story manufacturing plant and warehouse containing 50,000 sq.ft., at 6201-27 W. 65th St.

Sales

Cadillac Machinery Co., 528 Fisher Bldg., Detroit, Mich., has been appointed exclusive representative in the Detroit territory by Rockford (Ill.) Drilling Machine Co.

Foote Bros. Gear & Machine Co., Chicago, has recently appointed R. WIRTH to succeed A. H. TISCHER as district representative on IXL gears and speed reducers for the Indiana territory, comprising the State of Indiana, south of a line drawn east and west just south of Fort Wayne. The territory also includes the Ohio river towns in the State of Kentucky adjacent to Indiana. His headquarters have been established at 617 Merchants Bank Bldg., Indianapolis, Ind.

Anniversary

Gray & Dudley Co., Nashville, Tenn., one of the largest Southern stove manufacturers, is celebrating this year the seventieth anniversary of its founding. FOSKETT BROWN is vice-president of the company in charge of production and design. Four hundred men are regularly employed in the foundry. ERNEST BALDWIN factory superintendent, is in charge of both factories. HOUSTON DUDLEY is president and J. C. LAUDERDALE secretary-treasurer. One plant covers 17 acres with two foundries and a three-story factory; the other includes several large buildings, the newest 400x100 ft.

• PERSONALS •

GIUSEPPE FACCIOLI, Pittsfield, Mass., has been awarded the 1931 Lamme Medal of the A.I.E.E., "for his contributions to the development and standardization of high-voltage oil-filled bushings, capacitors, lightning arresters, and numerous features in high-voltage transformers and power transmission." The medal will be presented at the Summer Convention of the Institute in Cleveland, Ohio, June 20-24. The Lamme Medal was founded as a result of a bequest of the late BENJAMIN G. LAMME, chief engineer of Westinghouse Electric & Mfg. Co., to provide for the award by the Institute of a gold medal annually to a member "who has shown meritorious achievement in the development of electrical apparatus or machinery" and for the award of two such medals in some years if the accumulation from the funds warrants. Previous awards of the medal were to ALLAN B. FIELD, RUDOLF E. HELLMUND, and WILLIAM J. FOSTER. Mr. Faccioli retired May 27, 1930, from active duty as works engineer and associate manager of the Pittsfield Works, General Electric Co., and became a consulting engineer for the company. He was born in Rome, Italy, in 1877 and graduated with high honors from the Institute of Technology, Milan, Italy, as an electrical and mechanical engineer, in 1899.

DR. IRVING LANGMUIR, associate director of the research laboratory, General Electric Co., has been selected by a committee of 22 distinguished scientists, educators and prominent industrialists to receive the gold medal and $10,000 honorarium, offered by *Popular Science Monthly* as an annual award for notable scientific achievement by an American. Dr. Langmuir, who ranks as one of the nation's greatest research chemists and physicists, was selected from hundreds of candidates after an intensive nation-wide canvass, in which, 1,800 organizations cooperated. The committee which made the award was headed by DR. FRANK B. JEWETT, vice-president of American Telephone & Telegraph Co. The purpose of the award is declared to be two-fold—first, to honor Americans who have done notable scientific work and, second, to bring to the public's attention the value of scientific investigation, in order to stimulate a better appreciation by the public of such efforts. This is the second time the award has been made.

Dr. Langmuir's scientific work, which is thus honored, extends over 25 years. It began with his affiliation, in 1909, with the research laboratory of General Electric. His was the development of the high-intensity incandescent electric lamp (the bulb of which contains small quantities of either nitrogen or argon), a more powerful vacuum tube, and discovery of the new process of atomic hydrogen welding.

LAURENCE V. BENET, vice-president and managing director of Société Anonyme des Anciens Etablissements Hotchkiss & Cie, Paris, has had confered upon him the decoration of Grand Officer of the Legion of Honor in appreciation of his professional work in engineering and in industry in France.

HAROLD S. FALK, vice-president and general works manager, Falk Corp., Milwaukee, has been elected a director of Heil Co., Milwaukee.

W. CAMERON FORBES, former United States ambassador to Japan, has been elected a director of American Telephone & Telegraph Co., New York.

CHARLES B. KING, has resigned as vice-president of Marion (Ohio) Steam Shovel Co., with which he has been connected for 37 years. He is president of Ohio Manufacturers' association.

HAROLD SMITH, vice-president of Westinghouse Electric & Mfg. Co., East Pittsburgh, has been elected a director of Radio Corp. of America, to succeed the late H. P. DAVIS.

PAUL F. SISE, president of Northern Electric Co. Ltd., and director of a number of Canadian industrial enterprises, has been elected to the board of Dominion Engineering Works, Ltd.

NELSON W. PICKERING

Officers and directors of Farrel-Birmingham Co., Inc., Ansonia, Conn., were re-elected at the stockholders' meeting, Feb. 18. FRANKLIN FARREL, JR., continues as chairman of the board, and NELSON W. PICKERING as president.

Operating

HERBERT G. WINTER has been added to the research staff of Briggs Manufacturing Co., Detroit, to work especially in connection with minimizing auto body air resistance. He was formerly project engineer with Stout Engineering Laboratories, where he specialized in aeronautical research, particularly with reference to all-metal construction. The announcement was made by H. E. HUND, vice-president and general manager.

BYERS MOBLEY has become a mechanical engineer with Prest Machine Works Co., Oklahoma City, Okla. He had previously been with Okla. Gas & Electric Co. for seven years.

C. E. ANDERSON has been appointed auditor of disbursements in the Accounting Department, General Electric Co., to succeed the late F. D. KAMERER, according to an announcement by S. L. WHITESTONE, comptroller. Mr. Anderson has been connected with the company since 1924, and was previously assistant statistician.

THORNTON W. MCKAY, who has been with Union Twist Drill Co. plant at Athol, Mass., for the last ten years, has been made works manager of S. W. Card Mfg. Co., a division of Union Twist Drill Co.

HAROLD B. RESSLER, vice-president at Chicago of Joseph T. Ryerson & Son, Inc., has taken over management of the company's St. Louis plant. Mr. Ressler, formerly St. Louis plant manager for fifteen years, will be in direct contact with the St. Louis organization. In Mr. Ressler's absence, R. B. WILSON, manager of sales of the Ryerson St. Louis plant, will be senior resident executive. Mr. Wilson, formerly of the Chicago service department, has been associated with the St. Louis organization for over 17 years.

A. TRUDEAU, formerly connected with Beauchemin & Sons, now Sorel Steel Foundries, Ltd., has been appointed manager of Joliette (Que.) Steel Ltd.

JORDAN KORP, metallurgical engineer of Leeds & Northrup Co., Philadelphia, Pa., spoke on "Heat-Treating Abroad" at a dinner meeting of the Fort Wayne chapter, A.S.S.T., recently. He compared foreign and domestic methods and accompanied the lecture with motion pictures showing processes employed in foreign countries.

JAMES A. RABBITT, consulting engineer, has left for Tokyo where he will act as adviser in the establishment of a Japanese Bureau of Information on Nickel for the collection and dissemination of important scientific and technical data relating to nickel, its products and their application to industry. He will aid in the development of a staff of trained Japanese metallurgists for the bureau.

Sales

WILLIAM H. SCHEER, formerly in the Dayton territory working out of Cincinnati office of Ex-Cell-O Aircraft & Tool Corp., 1200 Oakman Blvd., Detroit, Mich., has been transferred to Chicago office and will be covering Northern and Western Indiana and the Southwestern portion of Michigan. H. E. HENRY, formerly working out of the Cleveland office, has been given charge of this territory and his new address will be 1240 Bender Ave., East Cleveland, Ohio. FRANK STROTHER, formerly in charge of the Cleveland territory has been transferred to the home office in Detroit.

LEON V. QUIGLEY, for the past seven years technical editor of Bakelite Corp., New York, has established his own business as Counsel on Public Relations, at 730 Fifth Ave., New York. He was director of public relations, publicity, and the educational program of Bakelite since 1925.

Organizations

DR. WILLIAM DAVID COOLIDGE, associate director of research laboratory, General Electric Co., has received the Washington award for 1932, "in recognition of devoted, unselfish, and pre-eminent service in advancing human progress," following a dinner and reception at the Hotel Sherman, Chicago. He is the eleventh to be so honored by the Washington Award Commission, the first presentation being to President Hoover, in 1919. Among Dr. Coolidge's best-known contributions are ductile tungsten for lamp filaments, wrought tungsten for contacts and X-ray targets, a hot cathode X-ray tube, various types of X-ray generating equipment, the "C" tube for submarine detection and signaling, and the cathode ray tube. The award was founded 16 years ago by John Watson Alvord, and is administered by the Western Society of Engineers. Presentation was made by FRANK D. CHASE, president of the society. Dr. Coolidge studied in Europe following his graduation in 1896, and then in 1905 he became a member of the G.E. research staff. He received, in 1914, the Rumford medal for his invention of ductile tungsten, and has subsequently been awarded the Homer N. Potts medal, the Lewis Edward Levy gold medal, the gold medal of the American College of Radiology, the Hughes medal from the London Royal Society, and the Edison medal. He holds honorary degrees of Doctor of Science from two colleges.

EDWARD N. HURLEY, JR., president of Hurley Machine Co., Chicago, has been elected president of American Washing Machine Manufacturers' association for a third term.

FREDERICK M. BECKET, vice-president, Union Carbide & Carbon Co., New York and PAUL D. MERICA, International Nickel Co., New York, were elected new vice-presidents of the American Institute of Mining & Metallurgical Engineers at its recent annual meeting. New directors include ERLE V. DAVELER, treasurer, Utah Copper Co.; EUGENE MCAULIFFE, president, Union Pacific Coal Co.; H. S. MUDD, consulting engineer, Los Angeles; J. B. UMPLEBY, petroleum engineer, Norman, Okla.; and CHARLES C. WHITTIER, consulting engineer, Chicago.

THOMAS A. ELDER, secretary of Electric Steel Castings Co., Indianapolis, Ind., has been elected second vice-president of the Associated Employers of Indianapolis. J. S. WATSON, vice-president and general manager of Indianapolis operations of Link-Belt Co. has been elected a director for three years to succeed GEORGE P. TORRENCE, who has been transferred to Chicago.

ALTEN S. MILLER, vice-president of Bartlett Hayward Co., engineers, 60 E. 42nd St., New York, has been re-elected chairman of the Library Board of the Engineering Societies Library for 1932. PROF. WALTER I. SLICHTER of Columbia University was named vice-chairman, and HARRISON W. CRAVER, secretary.

W. ROY MCCANN, president and general manager of Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.,

has been elected a director of Rochester Mechanics Institute.

H. HOBART PORTER of New York has been re-elected chairman of Engineering Foundation, research organization of the national societies of civil, mining and metallurgical, mechanical and electrical engineers. He is president of American Water Works & Electric Co., and chairman of the board of West Penn Electric Co., and a director in numerous railroads and public utility enterprises. GEORGE W. FULLER, consulting engineer of 170 Broadway, New York, was chosen first vice-chairman. He is a former vice-president of the A.S.C.E., and a member of Fuller &

DR. C. E. SKINNER

McClintock. DR. C. E. SKINNER, president of A.I.E.E., and assistant director of engineering of Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., was named second vice-chairman. GEORGE D. BARRON, mining engineer of Rye, N. Y., and D. ROBERT YARNALL, Philadelphia manufacturer and vice-president of A.E.C., were elected to the executive committee. DR. ALFRED D. FLINN continues as secretary and director.

• OBITUARIES •

WILLIAM J. ALLEN, 52, for 25 years treasurer of St. Louis Frog & Switch Co., died there recently.

HOWARD E. BOARDMAN, 52, Dudley Professor of Railway Engineering at Yale University, died in New Haven, Conn., Feb. 28, of pneumonia. He had been ill a week. Before joining the Yale faculty he had held important positions with several railroads, including the Pennsylvania.

WILLIAM H. COLE, 80, formerly traveling representative for Raymond Mfg. Co., Corry, Pa., manufacturer of wire springs, died in Corry, Feb. 16. Mr. Cole became associated with Raymond in 1910, previously having been identified with Tower & Lyon, New York. He was forced to retire two years ago because of poor health.

ALEXANDER Y. CUNNINGHAM, president of American Standard Watch Case Co., Providence, R. I., case manufacturing subsidiary of Bulova Watch Co., died at Providence, Feb. 15.

JOHN W. GALVIN, 84, for 3 years open-hearth superintendent of Inland Steel Co., Chicago, died at Long Beach, Calif., Feb. 17. Mr. Galvin, during his steel training at Nashua Iron & Steel Co., made some of the steel forged parts for the iron-clad *Monitor,* famous during the Civil War.

BENJAMIN B. GREER, 55, until last September president of New York Air Brake Co. and before that vice-president of the Chicago, Milwaukee & St. Paul Railroad, committed suicide Feb. 28 at his home in New Canaan, Conn. He had been worried by ill health and financial reverses since his retirement. He entered railroad service in 1899 with the Great Northern Railway.

JOHN T. HARRINGTON, 58, until recently a director of Republic Steel Corp., and at one time president of Trumbull Steel before it became a part of Republic, died Feb. 27, in Sydney, Australia, where he was on tour.

WILLIAM H. HOOVER, 82 founder and chairman of the board of Hoover Co., manufacturer of vacuum cleaners, Canton, Ohio, died Feb. 25 at his home in North Canton. He developed the vacuum cleaner from a makeshift suction sweeper developed by an asthmatic Cleveland janitor to keep from raising dust while sweeping, into one of the most extensively used cleaning implements. In 1907 he and his sons combined the principles of this invention and of the cleaner devised and patented by H. C. BOONE in 1901 and evolved the machine for the manufacture of which Hoover Suction Sweeper Co. was formed. The firm became Hoover Co. in 1922, when Mr. Hoover resigned as president and was succeeded by his son, HERBERT W. HOOVER.

Mr. Hoover retired several years ago from active business to devote himself to his philanthropies.

FREDERICK LANE HUTCHINSON, 65, noted electrical engineer and since 1912 national secretary of the American Institute of Electrical Engineers, with offices in the Engineering Societies Bldg., New York, died Feb. 26 in the Homeopathic Hospital, East Orange, N. J., of heart disease, after a brief illness of pneumonia.

ROBERT ICHTER, 59, foreman of Vulcan Iron Works, Wilkes Barre, Pa., for 30 years, died at Newton, Pa., Feb. 24.

JOSEPH KERKHOFF, 57, founder and general manager of Kenosha (Wis.) Die & Stamping Co., died Feb. 18 of pneumonia.

NORMAN R. KETTERING, 47, former plant engineer of Remy Electric Co., and for several years engineer in charge of construction of plants for General Motors Corp. abroad, died recently in Anderson, Ind.

J. WARBURTON KING, 63, inventor and mechanical engineer, died Feb. 28 at his home in Plainfield, N. J. He was an inventor of railway equipment, largely of structural types.

RAYMOND NEWCOMB, 34, vice-president, Kewanee Boiler Co., New York, and Fitzgibbons Boiler Co., Oswego, N. Y., died Feb. 16 of injuries suffered in an automobile accident near Selma, Ala.

HENRY NORTON, 75, a founder of Burgess-Norton Mfg. Co., Geneva, Ill., screw machine products, bearings and automotive parts, died Feb. 16 there.

FRANK A. REHM, 58, president of Winslow Boiler & Engineering Co., Chicago, for a number of years, who retired in 1929, died there Feb. 16.

ALBERT L. SCHULTZ, 69, head of A. L. Schultz & Son, 1675 Elston Ave., Chicago, died there Feb. 14. With FRED LEMLEY, Mr. Schultz organized in 1896 the company which manufacturers clutches and transmission machinery and is engaged in jobbing machine work, under the name of Lemley & Schultz. Mr. Schultz later purchased the Lemley interests and engaged in business with his son, ALBERT.

JOHN JAMES TOOLE, 79, former superintendent of Union Steel Casting Co., now Blaw-Knox Co., Pittsburgh, died Feb. 25 there. Mr. Toole came to this country from England in 1872, and started as foreman of Pittsburgh Steel Foundry Co. He had retired from his superintendency ten years ago.

• MEETINGS •

AMERICAN MANAGEMENT ASSOCIATION
Packaging, packing and shipping exposition, Palmer House, Chicago, Ill., Mar. 7-12, 1932. W. J. Donald, managing director, Room 602, 225 West 64th St., Chicago, or 20 Vesey St., New York.

AMERICAN WELDING SOCIETY
Annual meeting, Engineering Societies Bldg., New York, Apr. 27-29. William T. Spraragen, secretary, 29 W. 39th St., New York City.

FOUNDRY AND INDUSTRIAL EXPOSITION
Also 36th annual convention, American Foundrymen's Ass'n, Philadelphia Municipal Auditorium, May 2-6. C. E. Hoyt, manager, American Foundrymen's Ass'n., Inc., 222 W. Adams St., Chicago.

AMERICAN GEAR MANUFACTURERS ASS'N
Sixteenth Annual Meeting, Hotel Statler, Cleveland, Ohio, May 12-13. Executive Committee meeting, same place, May 11. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS
Annual meeting, Atlantic City, June 20-24. R. E. Hess, assistant secretary, 1315 Spruce St., Philadelphia, Pa.

NATIONAL MACHINE TOOL BUILDER'S ASS'N
Third National Machine Tool Show, Cleveland (Ohio) Municipal Auditorium, Sept. 10-17. Boyd Fisher, general manager, 1415 Enquirer Bldg., 617 Vine St., Cincinnati, Ohio.

NATIONAL METAL CONGRESS & EXPOSITION
174th Regiment Armory, Buffalo, N. Y., Oct. 3-7. Sponsored by A.S.S.T., with cooperation of A.S.M.E., Institute of Metals and Iron & Steel Divisions of A.I.M.E., A.W.S., and the Wire Association. W. H. Eisenman, 7016 Euclid Ave., Cleveland, Director.

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Opportunities for Future Business

Ill., Chicago—A. B. T. Mfg. Co., 331 Caroll Ave., awarded contract for constructiion of a 2 story, 36 x 90 ft. addition to factory for the manufacture of coin operating machines. Estimated cost $80,000.

Ill., Chicago—Cromwell Paper Co., 4801 South Whipple St., awarded contract for a 1 story, 89 x 215 ft. addition to factory at 47th and Whipple Sts. Estimated cost $50,000.

Ill., Chicago—Goodyear Zeppelin Corp., 1144 East Market St., Akron, O., plans construction of a hangar and repair shop at Pal-Waukee Airport here. Estimated cost $90,000.

Ill., Chicago—Phipps Industrial Land Trust Co., 39 South La Salle St., awarded general contract for a 2 story, 120 x 160 ft. factory at 1369 North Branch St. to Austin Co., 510 North Dearborn St. Estimated cost $100,000.

Ill., Joliet—J. F. Bittermann Steel Products Co., 1401 East Cass St., plans construction of a 100 x 200 ft. factory on Collins St. Estimated cost $75,000. Architect and engineer not selected.

Ky., Lexington—U. S. Veterans Bureau c/o L. H. Tripp, Chief Constr., Washington, D. C., will receive bids until March 8 for addition to garage building No. 3 here. Estimated cost $25,000.

La., New Orleans—Board of Levee Commissioners, Orleans Levee District, will receive bids until March 29 for a group of buildings including two 125 x 225 ft. hangars, 100 x 120 ft. repair shop, emergency and storage building, etc., at Shushan Airport on Lake Pontchartrain, National Airport Engineering Co. Ltd., 775 East Washington St., Los Angeles, Calif., Engr.

Mass., Boston—Department of Public Buildings, having preliminary plans prepared for construction of a police station and garage at site of present Joy St. station. J. M. Gray, 175 High St., Archt.

Mass., Cambridge (Boston P. O.)—Shell Eastern Petroleum Products Inc., 141 Milk St., Boston, will soon award contract for a service station at Memorial Drive and Magazine St. Estimated cost $25,000.

Mass., Milford—Niro & Niro Co., 61 Main St., plans reconstruction of plant destroyed by fire. Estimated cost $40,000. R. A. Cook, 57 Prospect St., Archt. Work will be done by separate contracts.

Mass., Newton—Shell Eastern Petroleum Products Inc., 141 Milk St., Boston, awarded contract for a 1 story service station at Beacon and Walnut Sts., Newton Centre. Estimated cost $25,000. Noted February 18.

Mass., Northampton—Clarke School for Deaf, M. Leonard, Round Hill Road, will receive bids until March 10 for construction of work shop buildings. Fechheimer & Ihorst, Provident Bldg., Cincinnati, O., Archts. Noted December 17.

Mass., Somerville (br. Boston)—Standard Oil Co. of New York, Park Sq. Bldg., Boston, awarded contract for a 1 story service station at Northern Artery and Greenville St. Estimated cost $25,000 to $30,000. Noted February 18.

Mass., Taunton—Brownell & Burk Co., Washington St., manufacturers of carriage and automobiles bodies, plans to rebuild factory recently destroyed by fire at Washington St. and Hodges Ave. Estimated cost $60,000. Private plans.

Mass., Watertown—Henry L. Kennedy, 80 Boylston St., Boston, Archt., completing plans for a 1 and 2 story, 40 x 150 ft. service station. Estimated cost $40,000. Owner's name withheld.

Mass., Weymouth — Crawford Machine Co., Central Ave., plans reconstruction of factory recently destroyed by fire. Estimated cost $50,000. Private plans.

Mass., Worcester—Central Supply Co., I. B. Smith, Pres. and Treas., having plans prepared for construction of a bus terminal at 40 Foster St. Stone & Webster Engineering Corp., 49 Federal St., Boston.

Nev., Boulder City—U. S. Bureau of Reclamation, Denver, Colo., will receive bids until March 10 for construction of one 20 car garage and two 12 car garages here. R. F. Walter, Denver, ch. engr.

N. J., Newark—J. L. Hammett Co., 380 Jellife Ave., rejected bids for 3 story, 60 x 105 ft. addition to school supply factory. $40,000. Holden McLaughlin Association, 670 5th Ave., New York, Archts. Project indefinitely postponed. Noted January 28.

N. J., Plainfield—Harold E. White Inc., plans addition to plant for the manufacture of automobile tops, frames, etc., at 417 Cleveland Ave. Site acquired. Maturity indefinite.

N. Y., Astoria—B. Holland, 48 South 6th St., Eaton, Pa., having plans prepared for a 1 story, 24 x 69 ft. automobile service and repair shop at Astoria Ave. and Ditmars Blvd. here. B. Chester, c/o owner, Archt.

N. Y., Buffalo—Irving Air Chute Co., 374 Pearl St., awarded contract for construction of a 1 story, 82 x 162 ft. factory and office building at 1668 Jefferson St. $40,000.

N. Y., Long Island City—Valentine Schiller, 3064 41st St., Long Island City, plans construction of a 1 story, 50 x 100 ft. service garage at 47th Ave. Private plans.

N. Y., New York—William Peat, c/o S. J. Kessler, 125 West 45th St., Archt., having preliminary plans prepared for a 2 story, 100 x 150 ft. service garage at 416 West 204th St. Estimated cost $90,000.

N. Y., Ozone Park—Beanor Service Station, Rockaway Blvd. and 130th St., having plans prepared for a 1 story, 38 x 82 ft. service station. A. Goldberg, c/o owner, Archt. Noted February 18.

O., Columbus—Department of Public Works, T. S. Brindle, Dir., Ohio-Hartman Bldg., will receive bids until March 28 for construction of a 4 story, 100 x 130 ft. addition to engineering experimental station at Ohio State University for use of Highway Department. Estimated cost $100,000. H. R. Rikert, c/o Ohio State University, Archt.

O., Lisbon—American Vitrified Products Co., 15 Broad St., Akron, plans extensions and improvements to plant here. Plans include kilns to be erected later in year, new loading dock, storage building, installation of conveyor system together with improved pipe turners and revolving tables; automatic coal hoist; electric drills for clay mines, etc., here. Estimated total cost $100,000.

O., Middletown—Department of Public Works, Ohio-Hartman Bldg., Columbus, awarded contract for construction of a 1 story, 65 x 112 ft. garage here for highway department. $27,550.

Pa., Edgley—Owner, c/o Haenichen Engineering Co., 222 West Broadway, Paterson, N. J., Engr., having preliminary plans prepared for a 2 story addition to paper plant at Slate Road and Delaware River. Estimated cost $40,000.

Pa., Huntingdon — Pennsylvania Industrial School, having plans prepared for construction of a central building containing shops, kitchen, etc., also cottage group and boiler house. Estimated total cost $325,000. Russell G. Howard, Dependent National Bank Bldg., DuBois, Archt.

R. I., Newport—H. L. Rooney, 116 Bellevue Ave., having plans prepared for construction of a 1 story garage and sales and service station. Estimated cost $50,000. E. M. Corbett, 49 Purchase St., Fall River, Archt.

Tex., College Station—A. & M. College, receiving competitive bids for construction of agricultural and engineering building. Estimated cost $200,000. F. E. Giesecke, College Archt. Noted November 12.

Wash., Tacoma—College of Puget Sound, Edward H. Todd, Pres., announced ten year building program to include dormitories for men and women, science hall, wood products building, etc. Estimated total cost $5,000,000. Money to be raised in form of endowments.

Wis., Kaukauna—Thilmary Pulp & Paper Co., receiving bids for a 1 story, 135 x 200 ft. paper bag mill. Estimated cost $40,000. Private plans.

Ont., Toronto—L. C. Smith and Corona Typewriter Co. of Canada, Ltd., 51 Madison Ave., New York, acquired building and plans establishment of assembly plant for typewriters here. Small equipment purchases will be made.

Que., Montreal—City Executive, considering construction of a garage on Champ de Mars. Estimated cost $1,000,000.

Equipment Wanted

Calif., Mare Island (sta. Vallejo)—Bureau of Supplies & Accounts, Navy Department, Washington, D. C.—will receive bids until March 15 for universal cutter and tool grinder, metal cutting bandsaw machine, floor type drill machine, mortising machine and shaper machine, sliding head drill machine, metal sawing machine, ball bearing bandsaw, floor type universal milling machine, all motor driven for Navy Yard here. Schs. 7533, 7536, 7535, 7534, 7581, 7582, 7586 and 7584.

Conn., Fairfield—A. Gray, Box 217—drill press and hand forge.

Fla., Pensacola—Bureau of Supplies & Accounts, Navy Department, Washington, D. C., will receive bids until March 15 for motor driven cutter and tool grinder. Sch. 7579.

Mass., Boston—G. R. Bacom Inc., 239 Columbus Ave.—bench miller.

Mass., Dorchester (Boston P. O.)—J. L. Major, 14 Harvard St.—6 ft. lathe set.

Mass., Palmer—S. C. S. Box Co.—No. 3 variable speed Reeves drive 3 to 1 ratio.

Minn., Minneapolis — Transit Supply Co., Snelling and University Aves., subsidiary of Twin City Rapid Transit Co., W. L. Larson, Purch. Agt.—drill press, 1¼ in. capacity, and brake for bending sheet metal, 16 gauge material.

Miss., Jackson—Lehman Co. of America, c/o Edgar A. Lehman, Cannelton, Ind.—double surface glue jointer and other equipment for woodworking plant here.

N. Y., New York—Ridge Steel Gypsum Partition Corp., c/o Pasquale Grassi, 271 Madison Ave.—will lease premises and equip. same for the manufacture of its products.

Pa., Philadelphia—Bureau of Supplies & Accounts, Navy Department, Washington, D. C.—will receive bids until March 15 for motor driven automatic screw machine for Navy Yard here. Sch. 7591.

Que., Lachine—Prolac Limited—12 or 14 in. iron planer.